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High-frequency Furnaces

AS the cost to industry of corrosion comes to be appreciated at its full value, so will the use of high-grade steels become general for many duties for which ordinary steel is now employed. This trend will provide one of the biggest fields for electricity, as there can be no question that the electric furnace produces the finest steel, and, indeed, provides the only method of obtaining certain qualities.

The first arc furnace was put down in Sheffield more than twenty years ago, and the aggregate capacity of this type in that district is now about 40,000 kW, individual units producing ingots of up to sixty tons. During the past seven years the high-frequency furnace has come to the fore in the manufacture of the highest quality of tool steel and special alloy steels required for a definite range of duties. Its popularity among steel manufacturers has increased rapidly, due to its ability to ensure freedom from contamination by sulphur, as compared with the crucible furnace, and by carbon, as compared with the arc furnace. In addition, the automatic stirring of the molten charge (which bears a relation to the periodicity of the current) maintains an intimate contact between the covering slag and the metal.

The high-frequency furnace has advantages over the older low-frequency furnace, chiefly in a much lower cost of upkeep of refractories and ability to melt from a cold charge. Heat losses are negligible, and the average efficiency is said to be about 70 per cent. overall from the h.v. bus-bars, whereas the efficiency of the crucible furnace is usually taken at about 4 per cent., and of the open hearth at from 10 to 15 per cent. It is also claimed that alloying elements are better conserved than in any other steel-making process.

The only characteristic of the high-frequency furnace that we regard as open to adverse criticism is its low power factor, necessitating the use of condensers, but we know of condenser installations that have been in quite satisfactory operation for several years.

The importance of the new high-frequency equipment at the Samuel Fox Works of the United Steel Companies, Ltd., is that it represents, as far as we are aware, the first attempt to make high-grade steel in considerable quantities by this method. The Company inform us that this plant enables them to produce steel equal to crucible steel at a cost that bears a very reasonable relationship to the cost with the open-hearth furnace. It also permits of quality refining, by which is meant the control of the content of dissolved gases, dissolved iron oxide and other factors determined by accurate temperature regulation before casting.

We were particularly impressed by the cleanliness of the melting shop at Stocksbridge and the favourable surroundings in which the men worked. This all helps to make the electrical production of steel into a precise scientific process carried out under laboratory conditions.

Electrical Manufacturing

BOTH Sir Felix Pole at the meeting of Associated Electrical Industries, Ltd., and Mr. W. C. Lusk at that of the British Thomson-Houston Co., Ltd., made encouraging references to the volume of business that has lately been received. At the works of the associated concerns about 2,000 more men are employed than was the case a year ago. Sir Felix, after referring to the particularly active state of the South African electrical market, and to the Warsaw railway contract, said that his optimism was strengthened by his recent tour of Ceylon and India, where he found signs of improvement everywhere. Mr. Lusk alluded to the better trade conditions in the latter part of 1933, which continued through the first quarter of 1934, and said that the employés of the B.T.-H. Co. were ten per cent. more than a year ago. Both gentlemen referred to the severe competition, to the problem of the excessive production in presence of a reduced demand, and to the need for reaching a solution. Mr. Lusk attributed the improvement in business generally to tariff legislation, and Sir Felix Pole referred to the value of the Government policy of negotiating trade agreements with the Argentine Republic,

Denmark, Norway, Sweden, Belgium, and Russia. The A.E.I. and its competitors are unitedly concerning themselves with the excess manufacturing problem; Sir Felix is more attracted by "planned control" of industry than by large-scale amalgamations. The export orders that both companies now have in hand should very favourably affect our 1934 figures, but we shall witness the most gratifying advance as the three world-disturbing factors of political unrest, trade restrictions and uncertain currencies exercise less serious retarding influence upon engineering enterprises. The reduction of the burden of taxation which was begun in Tuesday's Budget can hardly fail to expedite industrial recovery.

English Electric

The directors of the English Electric Co., Ltd., accompany their usual annual statement with a separate report on the past and prospective state of the business. The large loss on trading in 1933 is attributed to reduced turnover, due to a variety of causes, and to exceptionally low prices, due to home competition. They record the remedial measures that have been taken to bring about improved results:—(1) economy; (2) the extension of the policy of manufacturing lighter and ancillary types of electrical apparatus "on which the margin of profit has not yet been eliminated"; and (3) further efforts toward rational co-operation amongst the leading firms in the industry. The imperative necessity of restoring remunerative prices for heavy electrical machinery is stressed, and the directors express their readiness to play their part in reviving mutual trust within the industry and to carry their own legitimate share of whatever sacrifice may be necessary to that end. The report ends on a very encouraging note, for the unexecuted orders on the books at March 30th, 1934, were 80 per cent. more than a year ago, while recent orders have been taken at better prices than then prevailed.

"Half-a-Crown a Week"

The praise given to Sir Kingsley Wood and Major C. R. Atlee, his predecessor as Postmaster-General, at the banquet celebrating the ten years' propaganda work of the Telephone Development Association, was deserved. They have both done much to encourage the telephone habit by appreciating the need for active publicity methods. The Association's slogan implying that the hire of an instrument costs only "half-a-crown a week" has also been a factor in increasing the number of connections at a greater rate than in other countries during the slump. Scope has at last been given to our telephone engineers to make available for the public methods of communication that are in many ways the best in the world. The Treasury grant of £50,000 is still too meagre a proportion of the revenue to allow for publicity; American telephone companies budget for from 1 to 1½ per cent. of their revenue. The allowance for this purpose should not be a Treasury grant; it should be such a proportion of the trading surplus as the Director-General may consider requisite.

Choking Off

From examples brought to our notice it would appear that spontaneous enthusiasm on the part of would-be consumers for electricity, as such, is even now regarded by some undertakings as enough to absolve them from activity in load development. A request for information as to the saving to be derived by electric heating under a new tariff was recently made to a small supply company. The communication was ignored, but in reply to a further letter written ten days afterwards the writer was told that the officials of the undertaking were much too busy to furnish the particulars required, and he was recommended to make the comparison for himself. The tone of the reply was enough to damp any electrical bias that might have existed, but, apart from this, consumers cannot be expected to work out for themselves from a bare tariff schedule the relative costs of heating by electricity and other methods. Indeed, incidental advantages figure so largely in the comparison that potential users may, when left without guidance, prefer an alternative on superficial (if shortsighted) economic grounds. Shirking such a question may well give an impression of unwillingness to tell the truth!

Radio and Change-overs

We are constantly being asked whether electricity supply authorities are bound to make good radio sets which are rendered useless by a change in the system of supply. So far as we are aware no definite ruling has ever been made, although there was a case in which a contractor secured judgment against a supply authority for the replacement of battery-charging equipment which a change-over had put out of action. From the supply authorities' point of view the replacement of expensive equipment with a consumption of a few watts is not very economical, but some of them have decided to make such replacements when changing over. During the Committee stage of the Electricity (Supply) Bill, sponsored by Viscount Falmouth, a new clause was inserted definitely specifying radio instruments among the apparatus which must, if necessary, be "altered, adjusted or replaced" by a supply authority upon the occasion of a change-over. If the clause is allowed to stand there will at least be something tangible to go upon.

Electricity (Supply) Bills

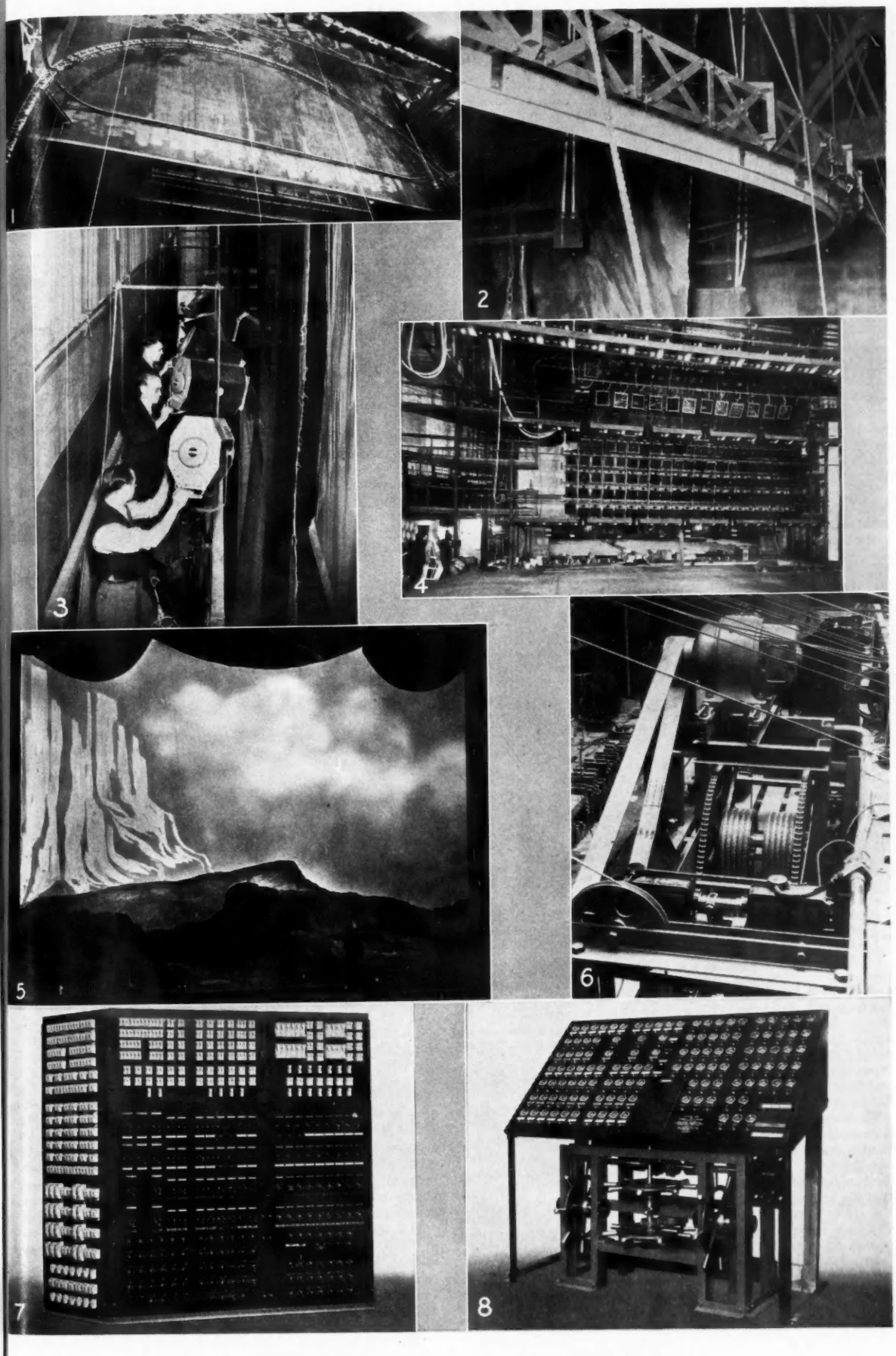
Is it essential that every Parliamentary measure relating to electrical matters shall be called an Electricity (Supply) Bill, without any sort of qualification or definition? A little while ago there was a short Bill bearing this title which was an amendment of sections of the 1919 and 1922 Acts dealing with compensation for displaced employés. Now there are two measures with the same title pursuing their weary way through the Parliamentary mill. One, which we call for convenience "Lord Falmouth's Bill," deals with a number of matters relating to supply to individual consumers. The other, the "Central Board's Bill," confers additional powers on that body. (The second reading of this Bill in the House of Lords is reported in this issue). Confusion has inevitably arisen in the daily Press and in the industry. We would suggest that future Bills should bear distinctive titles or, alternatively, that only one Electricity (Supply) Bill should be produced in any one year!

"Radio from Supply Mains"

The proposal under the Falmouth Bill to empower undertakings to permit the use of their supply networks for the transmission of at least two alternative programmes of broadcast matter differed from the clause deleted last year from the Middlesbrough Corporation Bill in that no question of municipal trading is involved. It was claimed in its support that the B.I. system of supersonic frequency transmission, which is capable of giving several simultaneous programmes, would stimulate the demand for high-class receiving sets (and not of loudspeakers only, as in the case of ordinary relay systems), increase the consumption of electricity, and help to spread the all-electric idea. If the first anticipation is well founded, we hope that the clause, which was dropped on grounds of policy, will be reintroduced in a more appropriate Bill, as there is plenty of evidence that lighting is used for longer hours in homes in which radio is used, and that radio itself can be relied upon as a pioneer of other electrical services.

News from Scotland

A Scottish paper reports the breakdown of a 1,000-kW "turbo-altimeter" set at the local electricity works. Such a set, we think, would go up before it broke down. Another Scottish contemporary has discovered the town with the cheapest electricity. Littlehampton, it says, paid 1s. a unit in 1933; it now pays 1/7th of a penny. We wonder who pays the balance.



Opera House Stage Lighting. (See page 553)

1. Semi-circular overhead cyclorama track. 2. Close-up of cyclorama track. 3. Stage-lamp operating gallery. 4. Stage cyclorama lanterns with control desk and fuse board on gallery (left). 5. Stage set with cyclorama background effects. 6. Cyclorama sheet winding gear. 7. Fuse board with quick "black-out" switches. 8. Dimmer control desk.

Steel Smelting and Refining

The new high-frequency electric furnace of the United Steel Companies, Ltd.

A FEW days ago we visited the Samuel Fox & Co., Ltd., works of the United Steel Companies, Ltd., at Stocksbridge, near Sheffield, to see the new two- and five-ton high-frequency electric furnaces that have recently been completed.

This equipment we believe to be the largest of its kind in this country, if not in the world, and its adoption is a result of the success obtained by the company with smaller units. The first of these was put down for making ingots up to 20 lb. of special steels for research purposes, including those relating to slags, linings and finishing alloys. Afterwards 5 and 12-cwt. furnaces, operated from the same generator, were installed for the production of high-class steel previously melted by coke.

The new plant will be used to make steel for such purposes as aircraft, racing cars, tools and dies, welding rods, ball and roller bearings. These furnaces are also especially suitable for the production of heat-resisting, stainless, permanent-magnet, non-magnetic and "nitralloy" steels—the last for hardening by the nitrogen process.

The value of the h.f. furnace for melting has been established for some time, but its suitability for refining is only now becoming recognised. Definite proof exists that carbon, manganese, silicon, sulphur and phorphorus can be removed, and slags can be devised which permit of carrying out the refining reactions at the somewhat lower slag temperatures found in this type of furnace.

The melting shop also contains a 15-ton producer-fired open-hearth furnace capable of rapidly preparing 5-ton charges of hot metal for the larger of the electric furnaces.

Both electric furnaces are arranged for acid or basic lining and tilt in both directions so that slag can be removed from the back and metal poured from the front. The hydraulic tilting mechanism works entirely below the operating platform and has a wide range of speed. Magnetic shields are provided between the inductor coils and the steel bodies of the furnaces. The tilting controls and switches are interlocked, and the voltage, power, and power factor of the furnace during the melting period are automatically controlled.

The charges are prepared in an "Efco" charging cylinder let into the furnace platform. A crane lifts the cylinder containing two tons of metal and lowers it into the furnace within two minutes. The time between switching off the current for casting and starting the next melting operation averages only six minutes, during which period the furnace is cast into the ladle, cleaned, prepared, charged and put to work again. The time required for other types of small melting furnaces is usually from twenty to thirty minutes.

In a local laboratory on the furnace platform are some small resistance furnaces for testing carbon and other alloys.

The 1,500-r.p.m. motor generator for supplying the furnaces is housed in a separate building about 80 ft. away, and the T.C.C. condensers are under the working platform.

The generator is an inductor homopolar single-phase machine of a new design developed by the Met.-Vick. Co. It comprises two 625-kW stator windings and a common rotor, but there is no interaction between the magnetic circuit of one stator and the excitation winding of the other. The voltage of each (1,500 V at full load) can be separately controlled and applied to two furnaces operating at the same time. Alternatively the stators can be connected in series to give 1,250-kW at 3 kV.

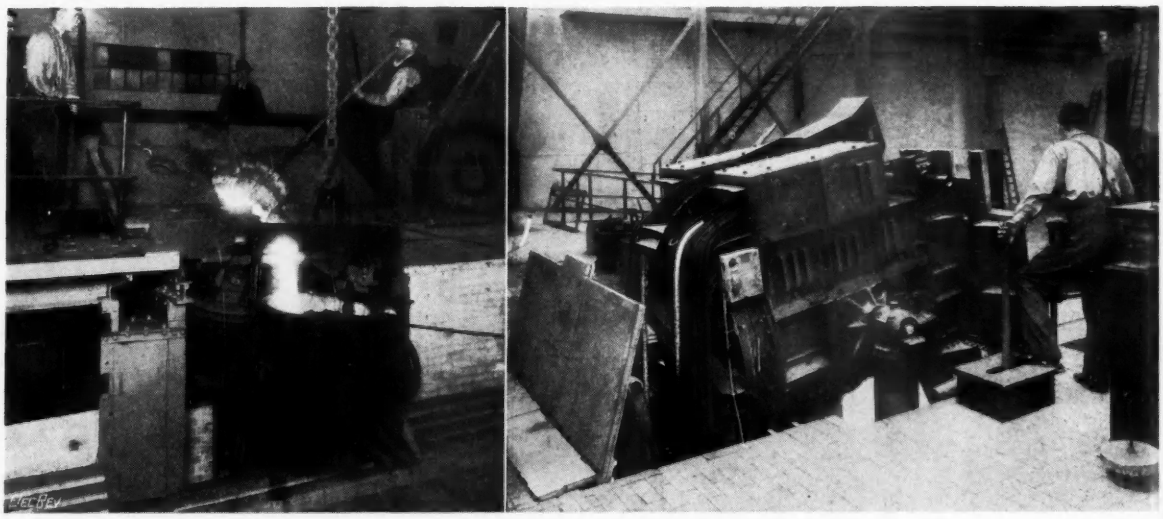
The normal frequency is about 1,250 cycles. The optimum value of the frequency depends partly on the amount of "crowning effect" (due to circulation of the metal) at the centre of the melt, which is inversely proportional to the square root of the frequency, and also upon the output of the furnace, the size of the scrap charged, and the cost of the motor generator and condensers.

The motor takes its supply at 11,000 V from the three-phase 50-cycle mains and is designed to correct the overall power factor of the works. It is tap-started from an auto-transformer. The operation of the furnace is fully automatic, thus enabling the melter to give his whole attention to the metallurgical work.

The output of the alternator is maintained at any value set by the furnace operator. The power factor of the furnace averages about 0.1, with considerable fluctuations, tending to fall as the charge becomes molten. It is kept at about 0.8 at the alternator terminals by automatically varying the number of condensers on load, the losses in which are only about 20 kWh per hour. A decrease in the power factor below a certain point shows that the furnace lining requires renewal.

The temperature of the charge may reach 1,600 deg. C., and water is circulated through the centre of the furnace coils in six sections and discharged at 110 deg. F. Relays prevent switching in or cut off the supply if the water supply fails.

The whole of the electrical installation described above was designed by Messrs. Campbell & Gifford in co-operation with the engineering and research staff of Messrs. Samuel Fox & Co., Ltd. The equipment was supplied by the Electric Furnace Co., Ltd., in conjunction with Metropolitan Electric Co., Ltd.



Tapping a 2-ton high-frequency electric furnace and (right) tilting one of the furnaces

The main research laboratories are not yet completed, but it would appear that they are destined to become a focal point of the works. Here are to be found some electric furnaces of another type—three small units supplied by the General Electric Co., Ltd. Two of these are for general heat treatment up to 1,000 deg. C., the internal dimensions being 11 in. high by 16 in. wide by 30 in. long, and 11 in. high by 15 in. wide by 30 in. long, and the loadings 14 kW in both cases. Both furnaces are equipped with automatic temperature control gear, the instrument in one case being a Cambridge potentiometric recorder and in the other a Cambridge direct deflectional type controller.

The third furnace is suitable for use at temperatures up to 1,350 deg. C., the elements being rods of re-fused silicon carbide. The temperature of this furnace is also automatically controlled, and a double-wound oil-immersed self-cooled tapped transformer is included to take care of the ageing of the heating elements. The internal dimensions of the furnace are 5 in. high by 8 in. wide by 16 in. long, and its load 9 kW.

The illumination of melting shop is controlled by photo-electric cells in two stages, for the side lighting and for "Osira" lamps in the roof. Further photo-electric developments are pending. The works provides a load for the Yorkshire Electric Power Co. of about 3,600 kVA, with a monthly load factor of 62 per cent.

Interconnected Power Systems. By S. B. Jackson, A.M.I.E.E.

Operation from control centres

THE operation of interconnected electricity supply systems may now be regarded as having passed the experimental stage. Progress has been made to such an extent that an expert technique has been developed. It is desirable to ensure the satisfactory co-ordination of all the factors involved in order to secure the beneficial results which interconnection makes possible.

The Central Electricity Board has established control centres for several of its regional areas situated in London, Leeds, Glasgow, Birmingham, Manchester and Bristol. A control centre in Newcastle fulfils the dual purpose of controlling the North Eastern Electricity Supply Co.'s system (which was formerly controlled from a centre at Carville and various subcentres) and the Central Board's main system in that area.

The main function of these centres, which in principle is applicable to all interconnected systems, may be summarised as follows:—

(1) The issuing of operating and other instructions to power station and C.E.B. engineers regarding the main switchgear, transformers and voltage-control equipment.

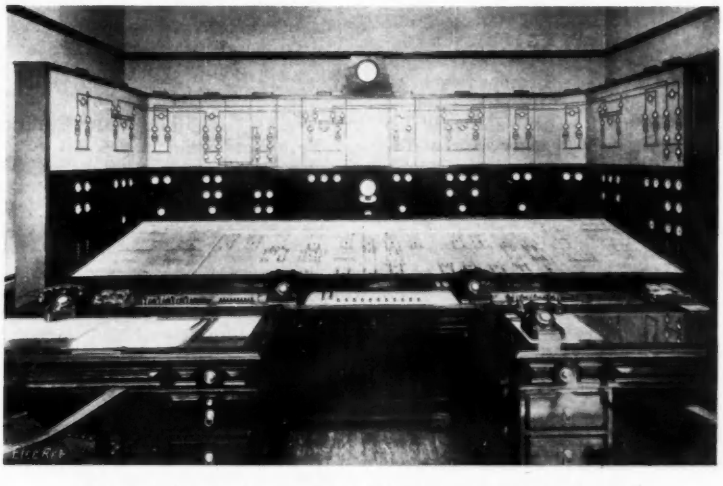
(2) The issuing of instructions to power station engineers regarding loading, frequency, voltage and power-factor control, reserve plant, starting up and shutting down, &c., and in certain cases the co-operation of water-power and other generating resources.

(3) The supervision of permits to work on all the Board's apparatus, making arrangements for supplies while generators, transformers and other plant are out of commission; the general supervision of tests on certain gear.

(4) Dealing with emergency conditions such as breakdowns affecting supply continuity, the restoration of supplies, and redistribution of station loading occasioned by altered conditions.

(5) Recording essential data relating to switching, voltage control, loading, plant commissioning, weather and the collection of information for operating and other purposes.

At these centres, automatic indications are provided for the main and secondary systems circuit-breaker operation (the lower voltage sections being excluded) and transformer tap-change positions, kW and reactive kVA, total generated load at specified points, certain line voltages, station import and export kW and reactive kVA. An instruction telegraph is provided for certain stations. Telephonic communication is either initiated from the control engineers' desk or *via* an exchange. Local considerations govern the choice of system. Various types of equipment are used to provide the necessary automatic indications, but all employ communication channels. Main system diagrams and mimic diagrams are standard; they take various forms and in one case a large map upon which the electrical features and the condition of the system are indicated has been installed. Usually the main diagram indicators are operated from the mimic diagram switches.

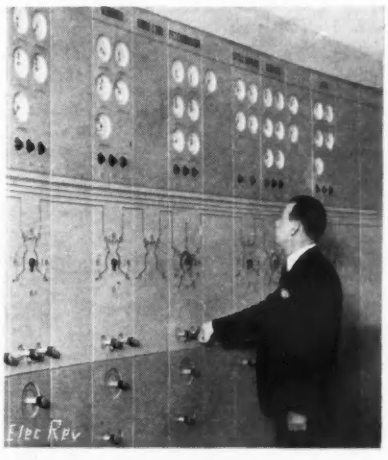


The central control room of the Mid-East England area at Leeds

Principles of Design

Speedy and reliable telephonic communication is the most important requirement. The communication system should be directly under the control engineers' control and, where desirable and economical, continuous indication of special features should be provided. The main system diagram should be laid out geographically, other considerations permitting, and crossing of lines should be reduced to a minimum, if they cannot be eliminated; the general design should enable rapid location of any feature contained and congestion should be avoided. Each designation should be clearly defined, according to a standard. In special cases it may be desirable to initiate meter readings from the control engineers' desks, but this introduces special complications in the operating mechanisms. Economy of cost of apparatus is not the determining factor, compactness, convenience and speedy access to the desired information being more desirable. Floor space is important if the site of the centre is located where the cost of land is high.

The considerations governing the choice of apparatus include an absence of complicated electrical relays or mechanical devices, easy maintenance, accessibility of apparatus, reliability, self-resetting features after selection has been completed and quickness in obtaining the various readings. High initial accuracy of metering is desirable and routine tests to maintain it are indispensable. The electrical and mechanical details of indicating and communication gear at present require expert attention and supervision, but with progress simpler systems may be evolved. Non-interference with communication channels is important and, in addition to regular testing and adequate supervision of pilots, means of instantaneously detecting and indicating faulty pilots should be provided. The accurate summation and indication at a central point of the generated loads of stations considerable distances apart present a special problem. Economical, reliable and accurate means are as yet not available for this purpose.



Mr. S. B. Jackson is engaged in the South-East and East England control room of the Central Electricity Board. Our picture shows him on duty

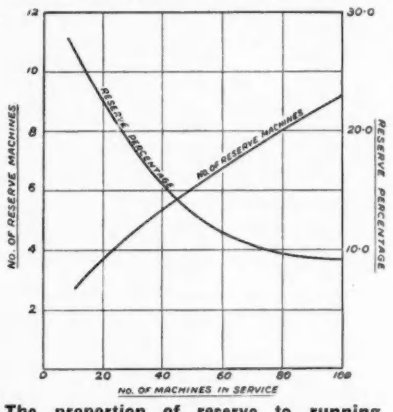
Refinements such as the initiation from the control centre of automatic synchronising at remote points, automatic selection of equipments at predetermined intervals, automatic time checks on standard clocks, anti-vibration floors upon which panels and instruments are mounted (thereby eliminating shock and assisting in the maintenance of accurate registration), and improvements in acoustic properties of control rooms may be included. Multi-coloured light diagrams of the shadow type are in use, particularly in power stations, but they are making their appearance in system control rooms, especially on the Continent. They, however, lack the essential qualities of compactness and easy maintenance. Fault-proof supervisors and premeditated switching devices are becoming standard.

Each interconnected system possesses its own characteristic problems requiring special treatment and the design of the control system should be deferred as far as possible until control engineers have had an opportunity to accustom themselves to the operating technique.

The principle function of control centres is to ensure a satisfactory supply, the essential requirements of which are continuity, quality and economy, ranking in this order of importance. Under British conditions economy is sacrificed to continuous and reliable supply. On the Continent and America continuity is not regarded to the same extent. Continuity is to some degree dependent on the system layout, but by careful and intelligent operation a high factor

of security can be obtained. Quality of supply may be considered as the maintenance of correct frequency and voltage at all times, immediate availability of reserve supplies during local disturbances, the speedy re-establishment of supplies after disturbances, and freedom from interference occasioned by troubles at remote points of the systems.

Modern discriminative protective equipment has helped to increase security, but in some instances rotaries and no-volt releases have been responsible for supply failures on distributing systems. This problem is receiving attention. Rapid re-establishment of supply is greatly facilitated by the receipt of accurate and complete reports from the seat and immediate vicinity of disturbances; each fault condition necessitates individual action and the steps taken are obviously dependent on the circumstances. Literature is already available on modern protective gear development. On certain systems schemes have been in existence for a number of years for automatically reclosing circuit-breakers after fault. These save time, attendance at sub-stations, and loss of revenue, and are of considerable help to the control engineer. The practice has not yet been adopted in this country as the conditions obtaining here require special treatment, but it might be used with advantage in some cases.



The proportion of reserve to running plant

Economical co-ordinated operation demands detailed analyses of works cost, station thermal efficiency and fuel costs, plant efficiency and transmission costs. Each of these factors may be deduced on the basis of increased increment cost against increased increment loading. The constituent items of each may be separated into their fixed and running components, as some items may be independent of loading.

Loading programmes should be drawn up as far as possible with reference to economic operation but, in general, considerations other than station economy influence the selection of stations and the allocation of loading. An example of this is where the steam station loads must be allocated in conjunction with the available water powers which vary according to season, rainfall, &c. Economic criteria may be used as standards of comparison for actual performances. Analysis of the main system and local load curves is required in conjunction with the preparations of load schedules.

Load-duration and integrated load curves are valuable in preparing estimates of plant requirements. They should be prepared on an annual and seasonal basis. The probable rates of increase of peak load are helpful under certain conditions. Day-to-day load forecasting presents a special problem and investigation is proceeding on the function of load with certain conditions such as temperature, day illumination, and other weather conditions. A satisfactory method of load prediction is not yet available, opinions differing on how load varies with particular items.

Reserve Plant

Reserve plant requirements are at present largely based on day-to-day operating conditions, and no definite rules can be established since they vary with every system, the reserve required being largely a matter for the judgment of the control engineers. On large interconnected systems the proportion of reserve plant can be reduced without affecting reliability of supply owing to the reduced possibility of several generators failing simultaneously. This is quite independent of the reduction of spare plant which interconnection and greater diversity allow. Plant reliability has in addition greatly improved, thus facilitating running within close limits. Consideration of the theory of probability of failure of units of the same size on systems having a given total number of units in service shows that the reserve requirements would be as indicated in the accompanying curve. Varying unit size affects the number of reserve units required. Risk, however, may be taken and smaller allocations made than those shown without seriously affecting reliability. Practical requirements such as situation of station on the system and system economy influence the choice and location of reserve plant.

Schedules of plant outage should be prepared, but in this country very little is being done in this direction. This procedure is quite usual in America where conditions are more favourable to the practice. On certain Continental systems where waste heat and other resources are available and where stations may be owned by a number of authorities operation is usually in accordance with agreements covering the amount, cost, and times at which heat may be utilised, &c.

In America large water-power schemes working in association with steam stations are operated on the basis of their relative economy at the various system loads. Transmission losses assume greater importance in that country than in Great Britain. In the same country some industrial power plants using mercury turbines and supplying heating steam for industrial processes operate in parallel with the public utility systems and supply current into their mains. These industrial plants form a source of cheap energy, but its disposal creates operating difficulties. Mutual co-ordination of the two sources of energy has not progressed very far (in fact opinions are divided on the advisability of these concerns operating in parallel) since it is dependent upon technical, competitive and political considerations.

Frequency Control

Frequency control presupposes the provision of load programmes for all stations, the use of accurate frequency-control clocks, indicators and recorders, and the employment of specified stations to frequency-control duty, the remainder running at constant loads. Frequency clocks throughout the system should be adjusted uniformly and large scales for speed differential clocks are essential. Frequency-control gear should be large enough to be read easily from any point in the control room. Frequency-control stations should be flexible, economical and situated with reference to probable interconnection loadings so that interference and adjustment is minimised. An analysis of the station costs as previously mentioned will determine the choice of stations and, in general, pulverised fuel plants are particularly suitable.

Close observation on interconnector loads must be maintained to ensure proper load distribution. Accurate maintenance of allocated loads by each station assists frequency control. Time checks on standard clocks are necessary three or four times a day. Fluctuating or suddenly rising loads require special treatment but on large interconnected system the tendency is for these loads to even out. On occasions when the system is divided into sections, correct and identical frequency control in each must be maintained as this greatly facilitates synchronising when returning to normal operation. Theoretically, if all clocks in each section are coincident synchronising is unnecessary.

Under such operating conditions specified stations are detailed for frequency control duty on each section; the loading and plant of other stations being altered to meet the altered load and reserve requirements. Automatic frequency control equipments are in successful operation. These usually compare standard with synchronous time the difference in which is transmitted *via* impulse relays to the governors which effect the frequency correction. Impedance devices, which almost eliminate hunting, are also in use. Both systems may be used for any number of generators functioning in parallel.

Rising and Falling Loads

Each station should pick up and drop off load as directed and as its physical characteristics allow; when coming on and off load, the rise or fall should conform to predetermined rates. Studies of the maximum rates at which stations can deal with increasing loads in the event of emergencies are useful. These rates are dependent on the size and type of plant installed. Machine governor characteristics should be standardised, thus enabling preservation of correct station load distribution under all conditions. Each member of the station operating staff should be in possession of information relating to probable operating conditions and emergency requirements.

As regards voltage control, light load conditions on large overhead line networks, and especially when these networks are associated with cable systems, present a problem of dealing with wattless kVA. Due to leading power factors and low loads generators approach the instability zone, but by the judicious handling of loading no serious difficulties have arisen. Automatic power factor control for generators is already in use. Such equipment permits accurate control of the sharing of wattless kVA between as many generators as may be running in parallel on the system, the share being allocated according to size. It is customary to adjust the appropriate loads on the generators by hand, leaving the power factor to be dealt with automatically.

The use of short-circuit calculators whether expressly designed for the system considered or for universal application is now essential on large systems. These instruments facilitate investigation of the severity of the short-circuit kVA values, thereby evaluating the duty imposed on switchgear at any point of the system under any conditions of operation.

Some Driving Forces in the Industry: W. & T. Avery, Ltd.

1. Mr. J. T. Burford, production engineer. 2. Mr. P. H. Mills, managing director. 3. Mr. E. Bowen, chief technical officer. 4. Mr. S. H. Johnson, general sales manager, engineering section. 5. Mr. A. Morley, commercial manager. 6. Mr. F. C. Gibson-Hill, sales controller. 7. Mr. A. Jacob, general sales manager, industrial visible weigher section.

Opera House Stage Lighting

Covent Garden re-equipped in quick time for cyclorama lighting effects

In preparation for what promises to be a well-supported season of grand opera, which commences next month, the whole of the stage-lighting equipment at the Royal Opera House, Covent Garden, which has done duty for so many years, was recently condemned as falling short of modern theatrical needs.

In its place an entirely new and in many respects noteworthy system has been installed by the Strand Electric & Engineering Co., Ltd., to the requirements of the joint architects, Messrs. Hood & Huggins and Frank Matcham, and their consulting engineer, Mr. Basil Davis.

Cyclorama Scenery

The Royal Opera House has now one of the largest and most flexible lighting equipments of any theatre in this country, with ingenious features which probably put it in the front rank of anything previously attempted, either in Europe or America.

The whole of the apparatus has been designed and made in this country in the record time of seven weeks, and the contractors have only had possession of the stage for five weeks.

A very large cyclorama of not quite semi-circular shape, reaching from the grid to stage level, which is used for obtaining the illusion of background distance, and on which sky and cloud effects and scenery can be projected, is possibly better visualised when it is said that nearly 15,000 sq. ft. of specially woven material has been used in its manufacture. In spite of its great size it can be entirely rolled up into one corner of the stage in 30 seconds. The gear with which this is accomplished has been built and installed by Lift & Engineering, Ltd. (Messrs. C. E. Shields and T. G. Murray).

This cyclorama installation is claimed to be the only one of its type that has been designed and built throughout in this country. The back sheet is in this case 115 ft. long and 59 ft. 6 in. high. It is suspended round the sides and back part of the stage from an overhead lattice steel girder track, which is semi-circular in shape and hinged to fold flat when exceptional head room is needed.

When not required for lighting purposes the cloth is rolled up at one side. This is done by a spirally grooved cone suspended from the grid, the shaft of this cone being threaded in one of its bearings at the same pitch as the grooved cloth drum. The head of the cloth is sewn round a special rope, which is carried in a split track beneath the steel semi-circular supporting frame, the inner end of the rope being anchored to the lower end of the spiral drum. The outer end goes across the grid and round the drums of the winding winch, and is finally anchored to a further drum mounted above the spiral drum. On starting the winch for winding up the cloth the rope is drawn off the top drum and therefore also rotating the spiral drum, which begins to wind in the rope with the cloth attached. The vertical and horizontal pitches of the groove are such that each turn of fabric hangs outside and clear of the turn below, the pitch of the shaft thread keeping an open groove always in line, the rope and fabric coming out of the track.

The winch consists of two sets of winding drums, one set for each direction, the drums in use being engaged by electrically operated clutches, the other pair running idle on the paying-out side. The 5-h.p. totally enclosed driving motor thus revolves in one direction only. Control is exercised by a tramway type reversing controller fixed in a convenient position near the stage. The step sequence is, first, direction limit (if the limit circuit is closed) closing the line contactor. The second engages the direction clutch, while the third to sixth are motor steps; additional interlocking contacts are provided for overwind limits.

Coloured Lighting

The apparatus for lighting the cyclorama consists of two massive wrought-iron frames hanging from the grid, which together carry 150 "Sunray" lanterns of 1,000 W each, used for illuminating the upper parts, while for the horizon lighting movable trucks carrying a further 72 similar lanterns are provided. The whole of this lighting (222,000 W) is in three colours only, which have been found after much experimental work by the Strand Electric Co. to be blendable to such an extent that most requisite colours in the visible spectrum can be obtained. It is difficult to believe when the cyclorama is fully illuminated that no white light is being used.

The more orthodox portion of the stage-lighting equipment consists of footlights, five "Sunray" battens (with provision

for a sixth), and a lighting bridge. The battens are not continuous lengths as is usual, but have fitted between the sections numerous spotting, flooding, and acting area lanterns, which enable any small area of the stage to be picked out, and there are enough of these lanterns to run through a long opera to spot or flood any local area without altering the position of a single lantern after it is adjusted at the beginning of the performance. No. 1 batten hangs immediately under the bridge and in order to raise and lower this batten a special arrangement of diverting pulleys and steel lines has been fitted.

Two sections of the dimmer bank during assembly at maker's works

The lighting bridge on which operators can comfortably work has altogether twenty-four lanterns of different types, some being fitted with arc lamps for producing optical effects, others flood lamps, while there is also a battery of spotting lanterns for following artists about or for any other similar purpose. There are also three perches on each side of the proscenium equipped with rather uncommon low-voltage large-current spotting lanterns which, although only fitted with 1,000-W lamps, give an unusually brilliant light. Incidentally, the Strand Electric Company used this type of lantern for floodlighting the Nelson column two and a half years ago. Three lanterns of this type are also provided in the auditorium dome. These, however, have the additional feature of automatic colour changing through the medium of solenoid-operated semaphor arms controlled from the switchboard.

For the connection of portable apparatus a large number of stage dips have been fitted, and in this section of the installation a certain amount of white light is provided, so that interior scenes can have windows illuminated to simulate sunrays, or to throw the heavy shadows which are required for certain artistic effects.

When the lighting rehearsal was in progress a scene was set for "Der Rhinegold," the foreground being rocks, and on the background cyclorama was projected the vision of the Palace of Valhalla in the sky with the rainbow forming a bridge to the Palace from the rocks, combined with a beautiful representation of moving clouds. It is extraordinary that such a complete illusion can be obtained by lantern slides and light.

Ubiquitous Remote Control

It will be readily understood that to get the best out of such a large installation the control must be exceedingly precise and ubiquitous, and it is in this respect that the greatest ingenuity has been shown. The switchboard platform is comparatively small and it would have been utterly impossible to accommodate the dimmers in four times the space, to say nothing of the fact that had the space been available the operation of the apparatus could not be effected in the "slick" manner necessary during a performance.

Actually the dimmer bank is 34 ft. long and 8 ft. 6 in. high, while the control desk for it is reduced to 5 ft. 9 in. by 2 ft. 9 in. This part of the apparatus was devised and designed by Mr. M. Mansell, a director of the Strand Electric Co., and manufactured under his supervision at the company's Gunnersbury works.

The dimmers are housed in a special chamber in the lower basement of the theatre and are built in two sections for controlling the cyclorama and colour lighting respectively. The motive power, however, is manual, and is transmitted from the control point by steel shafting. As 220 ft. of this has been used, and yet it is possible to operate the dimmers by hand with ease, it will be realised what care has been exercised in the design and installation. Of course, the shafts run in self-aligning ball bearings, sixty in all being used.

Below the control desk panel there are four capstan wheels, vertical ones on the right and left being the slow masters and horizontal wheels the quick masters. A small lever between the horizontal wheels operates a sliding sleeve, which is splined on its outer diameter, so that it can be engaged with an inner splined sleeve to couple the two quick masters and give control of all the dimmers by one wheel. As it is essential that the line shafts be always turned in the same direction, all the capstans are fitted with a free wheel device which prevents the shafts being turned in the wrong direction, and also enables the dimmers to be operated by moving the capstans backwards and forwards, thus effecting a most sensitive control. There are now 130 dimmer controls in addition to the automatic colour-changing switches and master switches.

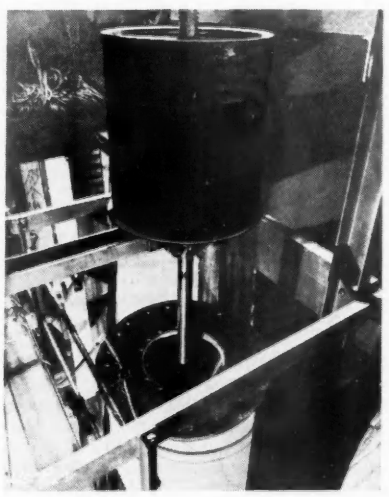
The small indicators on the control desk are neither ammeters nor voltmeters, but have been specially designed to show the percentage of maximum light remaining in every circuit after dimming has taken place, which is also neither proportional to current nor voltage. These instruments are illuminated from the back and can all be read on a darkened stage. They are energised by potentiometers eccentrically contrived to provide logarithmic indications on the control desk dials.

Below each instrument is a two-way-and-off switch which controls the dimmer clutches. These are connected in such a way that with the dolly up lights are raised, with the dolly down lights are dimmed, and with the dolly central dimmers remain stationary. It will thus be appreciated that complete and independent control is given over every group of lights, enabling the maximum amount of fading and blending to be effected in either the most gradual fashion or rapid time. Dimmers can be coupled or disconnected while the capstan is being turned, the lighting responding immediately without the lapse of time usual with the older type of equipment.

The dimmer clutches are pairs of electro-magnetic coils which, when energised by the dolly switches on the desk control board, adhere to discs on the capstan-operated line shafting. Thus while the shafts rotate in one direction only, the coils adhering to them push or pull links which insert or extract dimming resistance.

Although most of the lighting control is effected by the dimmers, switches are necessary on the stage fuse board for extra quick "blackouts."

The neat manner in which the back of this switchboard is connected appears to have been followed by the contractors throughout the job. The complete installation was erected under the supervision of Mr. L. G. Applebee, of the Strand Electric Co., who informs us that upwards of fifty miles of cables, several miles of conduit, and some thousands of "Osram" lamps have been used. The whole of the apparatus is British and has been manufactured in London.



Double-cone cyclorama-sheet winding gear

Naturally an installation of this magnitude has necessitated the augmentation of the incoming supply of electricity to the theatre. For this purpose the Charing Cross Electric Supply Co. has equipped a special sub-station in the basement for the accommodation of new 11,000-V feeders, transformers, switchgear, and metering equipment for a total connected load of approximately 700 kW a.c. at 230 V for incandescent lighting and of 150 kW d.c. at 100 V for arc lamp lighting.

The finishing touches are now being put to the reconstruction schemes in the foyers and to other amenities in front of the theatre preparatory to opening of the season on May 1st.

Modern Welding Equipment

Machines and processes

THE following are our impressions of the answer, verbal and otherwise, of Mr. W. Meacher, M.I.E.E., director Westminster Engineering Co., Ltd., to our question "What is the trend of development in electric welding?" The company were the original manufacturers in this country of resistance welding machines under the Thomson patents, and for many years they designed and built machines for the Electric Welding Co., which at that time held the patents. The first machine was made in 1902 for the Wolverton Works of the L. & N.W. Railway for welding draw bars, and it is still doing good work. It has a transformer in its base, and is controlled by a foot pedal which operates an air break switch in the primary circuit of the transformer. Water-cooled copper jaws are clamped by screw gear, and there is one moving water-cooled platen, upset pressure being applied by a 12-ton hand-operated hydraulic jack—a slow method of welding giving the best control.

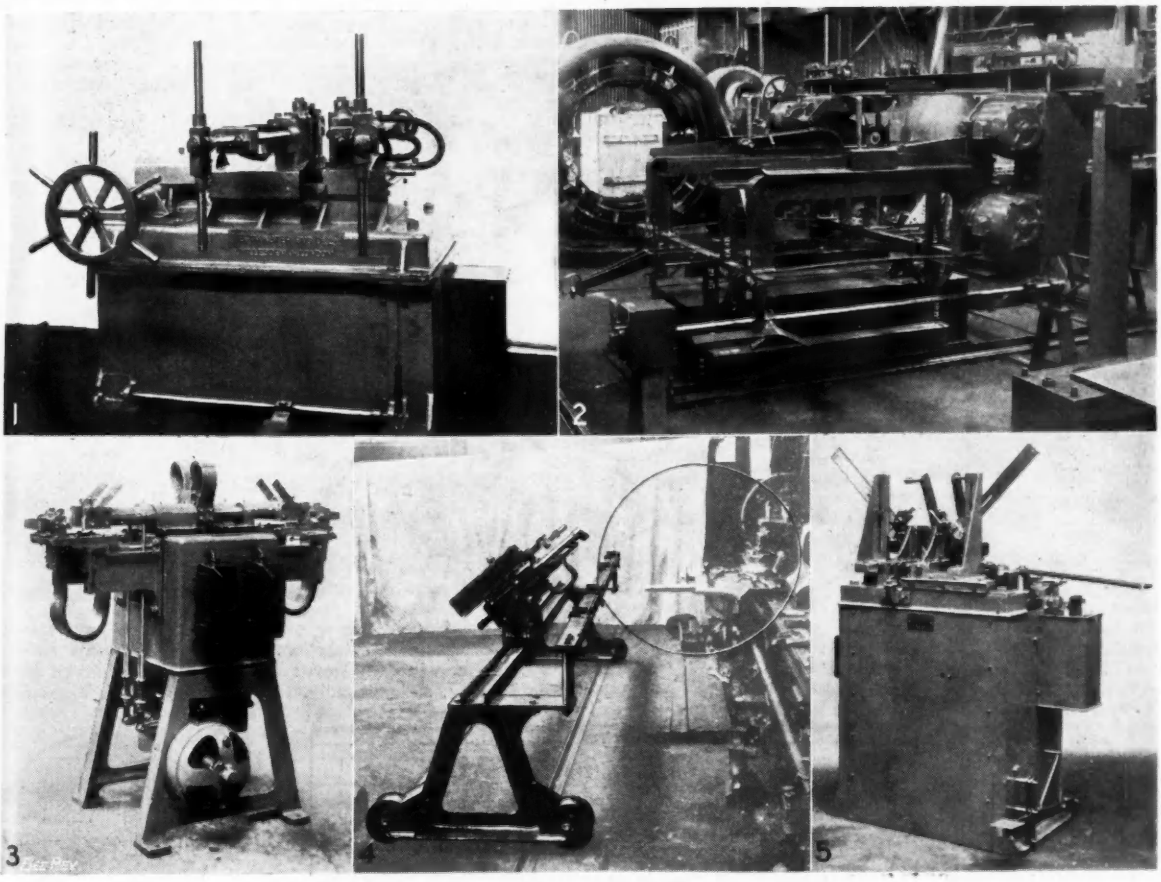
In slow welding the metal is never brought up to a temperature beyond its melting point, but in fast welding, a more recent development, that temperature is far exceeded, and just before the current is cut off, application of the upset pressure squeezes out the burnt metal, leaving the sound faces in perfect contact. There are fields for both methods. For tube work the slow method is more suitable, because there is practically no internal upset. The tube tends to push outward and the external upset can be swaged down after welding. But with quick or flash welding, there is considerably less upset.

Where the two welding faces have different areas the slow method cannot be adopted because different temperatures prevail at the faces in contact. For example, folded framework steel bars of complicated section can be welded only by the flash method. This also applies to delta-metal for motor-car windscreens, which, it was found on test, can be welded electrically, with favourable rates, at about one-eighth of the cost of oxy-acetylene. In a sash-bar butt welder, which keeps the welding faces in gentle contact until uniform temperature is reached, a standard steel window-frame weld is effected in six seconds. Tee-iron welding is another example; the end of the stem is burnt away until the required temperature is attained in the cross piece. The parts are then closed up under heavy pressure.

Mild steel can be welded satisfactorily by either the fast or slow methods, while increase of carbon content favours the fast method; indeed really high carbon steels can be welded only by the flash method. A high carbon steel job catered for by the company is the production of rings from bars. Cut to dead length, two bars at a time are heated uniformly throughout their length by virtue of their resistance in a 40-kVA heating machine. After being shaped into rings in a bending machine they are clamped in the toggle-operated jaws of a 15-kVA butt welding machine which is trip-switch operated by the moving platen. Careful adjustment of bar length and upset results in correct circumference. It takes 29 seconds to heat the two bars (¾ in. square) simultaneously, and two seconds to effect a flash butt weld. Mild steel has a wider temperature range for welding; the limits for copper are narrower; and those for aluminium are narrower still.

Equipment for the Westminster system of electrically welding steel wire fabrics for reinforcing concrete pipes is adjustable so that it can be quickly set to weld wire fabrics from 7 in. to 63 in. diameter and up to 8 ft. long. Any number of rings or longitudinal wires may be used. A supporting bar with movable stops holds the rings to be welded in the required position. A channel bar has corresponding movable stops which register the position of the rings and also support the longitudinal wire to be welded to the rings. A portable welder travels on a steel girder and is pivoted so that it can be tilted to pass each ring when welded. Each weld is produced by moving a controlling lever on the portable welding machine and this operation takes under two seconds. Immediately the welds are completed the cage is rotated on the supporting bar and a new longitudinal wire is placed in position. When completed the cage is drawn endwise off its supporting bar.

For the production of lorry tyres plain rings 6 in. by 3/16 in. are flash welded in 14 seconds in a 90-kVA machine, and the edges are flanged over cold after welding. For slow welding 6-in. diameter tubes are welded end to end with no internal upset in a 120-kW machine, which is provided with a 12-ton hand-operated hydraulic ram to close up the weld. Another slow welding machine is a 40-kVA equipment for dealing with

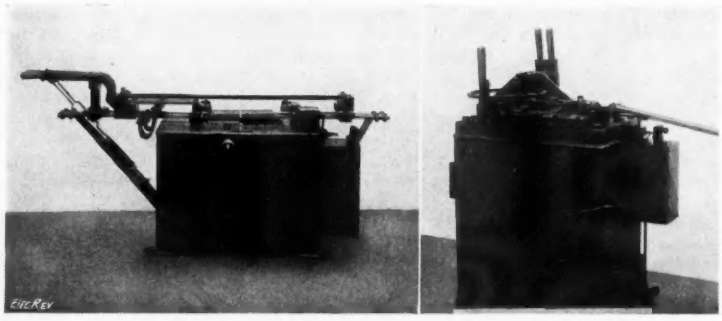


Some Westminster Electric Welding Apparatus

1. A 40-kVA butt welder. 2. A double-scaling machine for grinding metal edges before seam welding. 3. A double-operator twin spot welder for attaching razor box hinges. 4. A portable spot welder. 5. A sash-bar welder

worn link rods which support railway carriage springs; a very fine upset control being obtained by worm and reduction gear.

Among the spot welding developments we saw a double-head machine with four rocking electrodes for welding hinges on to razor boxes. It is a two-operator machine arranged so that twin spot welds are automatically produced at either end of the machine. This is loaded at 15 kVA. The advantages of spot welding over riveting were stressed. There is no corrosion at the rivet heads and correct register for the two half-shells for large cylindrical moulds is easily obtained without expensive drilling jigs.



Left: A ring and bar electric heater. Right: A ring butt welder operating in conjunction with this heater

Because the resistance of the material may vary between one spot and another, there is a special auto electric attachment for aluminium spot welding which is so timed as to put a predetermined number of watt-seconds into each spot. The tripping is controlled by dash pot and solenoids operating a quick-break switch.

Seam Welding

Seam welding, which is effected by chain-driven rolling electrodes, has been given much attention by the company. For lap seam welds difficulty was presented by the necessity of using the best material free from scale, and even then it was necessary to pickle the metal before use. Plucking at the surface occurred and particles of steel adhered to the copper rollers, which if not cleaned off resulted in a hole in the plate the next time that part of the rolling electrode came into action. Interrupting the primary circuit of the transformer, so as to get overlapping spot welds, obviated this difficulty, but it was still necessary to clean the plate. It was found that the cheapest plate could be satisfactorily welded if the edges were properly scaled and, because they were often buckled, this presented a formidable difficulty, which has been overcome by the Westminster patent scaling machine. In this machine the plates are carried on a moving trolley, the edges being securely clamped in a flat condition adjacent to the grinding wheels. These wheels, carried on floating arms, are concentrically driven by oil-immersed chains housed in gear cases and held to the work by a bridle spring so that uniform grinding pressure is exerted upon plates of unequal thickness or wavy contour.

A 5-kVA machine for seam welding the zinc pots for primary batteries was nearing completion at the time of our visit. This operates at 9 ft. per minute on the interrupted current principle. A certain amount of judgment is required to adjust the three variables, voltage between the electrodes, speed of travel, and pressure between the electrodes so as to get the best results.

A wire welding machine loaded at 5 kVA which will deal with wire as small as 0.018 sq. in.; a bench type spot welding machine for connecting strips of safety razor blades before grinding; a slow welding machine for building bosses on flat bar by a triple weld; and a tube heating and bending machine designed for obviating the stress on lap welded ¾-in. tubes for water heating panels (15 kVA) are other specialities of the company which we observed.

Induction Coil Cores. By J. F. Romer

Laminations *versus* iron wires

THE increasing use of the induction coil instead of the magneto for automobile ignition has resulted in coil design being radically altered, the classical form having proved inconvenient in practice and unsuitable for large-scale production. Among other changes has been the substitution of laminated for iron wire cores, the plate core being much easier to manufacture.

Although theoretically the wire core gives a lower eddy-current loss than a laminated one the iron space factor is low because the wires are seldom straight, and even after elaborate rolling operations the core is rarely tight or round. To obtain the highest efficiency both primary and secondary coils should be circular and the core should completely fill the available iron space. With a single pack of plates forming a rectangular core a reasonable iron space factor can only be obtained by using rectangular coils. This is undesirable, not only because the amount of copper required is increased, but also because there is an increased tendency to leakage and breakdown at the corners of the secondary coil of the unit.

A large part of the output of an ignition coil is wasted in leakage through dirty sparking plugs. This prevents the secondary e.m.f. from rising as high as it otherwise would do, and, as the resistance of the spark gap during the time the spark is occurring is low, the current is very largely determined by the secondary resistance. It is therefore desirable to use circular coils which have minimum perimeter and resistance.

A number of manufacturers following standard a.c. transformer practice make the core of plates of several different widths, which are cemented together. An induction coil, however, unlike an a.c. transformer, has great magnetic leakage, the fluxes leaving the core at the poles and at points in between differing considerably, so that the e.m.f.s induced in the laminations, although in the same direction, are not of the same strength; there is consequently a tendency for eddy currents to circulate in spite of the plates being insulated from each other.

This is shown by the arrows in fig. 1, which illustrates a common form of construction. These eddy currents reduce the efficiency in two ways: first, they absorb power from the primary, and, secondly, they prevent the condenser discharge from completely demagnetising the core and thereby reduce the secondary e.m.f. It is evident that if the width of plate is reduced the induced e.m.f.s and, consequently, the eddy currents are also reduced, becoming the minimum with wires.

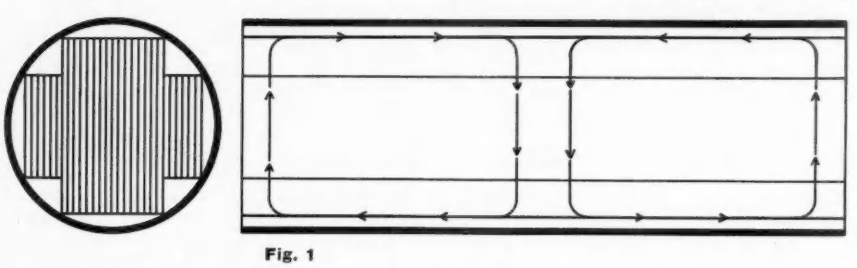


Fig. 1

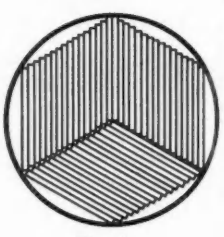


Fig. 2

The construction shown in fig. 1 is also not the most economical to manufacture, a better form being illustrated by fig. 2, in which the plates are all of the same width and are arranged in rhombus-shaped groups with a thin sheet of insulation between the edges of separate packs. As the width of plates is only half that of the centre part of the core shown in fig. 1, the eddy currents will be less than half, while the iron space factor is somewhat better, being 0.75 compared with 0.71 for the core shown in fig. 1 and 0.70 for a core composed of 26 s.w.g. wires, 10 per cent. being allowed for insulation in every case.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

The Testing and Employment of Rubber Cables

AT a meeting of the London Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS on April 10th a paper on "Quality in Rubber Cables," presented by Dr. P. Dunsheath, to which reference was made last week, was discussed.

Mr. F. C. Knowles, commenting on the tropical tests mentioned in the paper, referred to the fact that negative potential was applied, and said that in his own experience—not with cables but with fine wires—the only satisfactory accelerated tests were those in which current was used. It was often an advantage to apply the current intermittently, because certain conditions tended to re-establish themselves when the current was off and the next passage of current seemed to create a re-burst of activity, so that the test was further accelerated.

Mr. A. F. W. Richards said that the chief lesson to be learned from the paper was that while the usual insulation resistance and pressure tests showed up defects in manufacture, they formed little or no guide as to the probable life of a cable; physical tests were necessary to determine this. He did not think anybody in this country was yet in a position to use the oxygen bomb test as a routine test. Had not the time arrived when the use of pure rubber might be discontinued altogether on ordinary commercial wires? Flexible cords were a bugbear and a source of danger; they might ultimately sacrifice a little of the flexibility and replace the rubber by something of the nature of cambric, which did not deteriorate with heat.

Dr. Dunsheath replied that the oxygen bomb test was primarily a research test, because of the expense and difficulty of carrying it out. He did not think there was a very real need for such complicated tests for acceptance purposes. They should be used rather as type tests. The Geer test was an accelerated form of manufacture as well as an accelerated form of use. If rubber which was not properly cured were placed in the Geer oven its properties would be improved. Cable makers had raised the safe working temperature for flexibles from 48.8 deg. to 60 deg. C., and lamp fittings manufacturers had practically promised to produce fittings which would not attain a temperature of more than 60 deg., so that the two interests were brought into line.

In the Tropics

Capt. A. C. Sparks said he was disappointed with the evolution of cables for use in the tropics, where there was an enormous field for the right type as opposed to the paper cable. Mr. J. Urmston said that one or two rubber cables were working at 132,000 V with something like 80,000 V to earth, and there were many X-ray installation cables working at about 73,000 V a.c. and 40,000 V d.c. It would be rash to say, therefore, that rubber cables would never be used for high voltages. A hysteresis loop test would be far better to-day than those referred to in the paper, for it took into consideration not only the tension stress but also the contraction of the rubber after stressing.

Dr. Dunsheath replied that the development of rubber for high voltages would attract a good deal of attention. But X-ray practice was very different from power requirements. It was the loss in the dielectric under the alternating stress which caused the trouble.

Sealing Problems

Mr. C. Baguley said the point at which a cable emerged into the air, at joint boxes and the crutch of a three-core cable, for instance, was the weak spot. Mr. P. F. Grove said that in the design of sub-stations for the Central Electricity Board's national grid system very serious consideration had to be given to the selection of suitable cables for the multi-core control connections for switchgear and transformers. The types of insulation that were being selected were paper, cambric, and rubber. Paper- and cambric-insulated cables needed sealing, which increased cost, although the paper cable was perhaps cheaper than the rubber. There were always problems with tails and there had been evolved a scheme whereby the paper was bared back into the sealing end and the cores were sweated together near where the paper ended. From that point a "Sistoflex" tube was slipped on to the conductor and the whole box was run in with compound. In order to seal the conductors completely where they were sweated, to prevent moisture running down the inside of the "Sistoflex" tube, small circular spacers were slipped over the wire to keep the "Sistoflex" away from the paper insulation and to enable the compound to gain direct access to the sweated wire.

General view of melting shop; electric furnaces and pits at the works of the United Steel Companies, Ltd.; and (right) teeming a 5-ton cast of high-grade steel **(See page 550)**

Cambric covered cables for small connections were more expensive than rubber cables, and if they were not sealed they might give rise to difficulties. Therefore, in many cases rubber cables had been selected for all the multi-core connections. They were lead covered and armoured, but still problems arose with tails where the cores emerged. The rubber covering was liable to very serious deterioration in a short time, not under special conditions but under the ordinary atmospheric conditions of this country. In some quarters it had been considered desirable to compound the crutch of the cable, and in others to tape and varnish the rubber insulation to prevent the access of air. For connection to transformer equipment in the vicinity of oil the tails of rubber cables where they emerged from the lead sheathing were sometimes painted over with crank-case enamel, the cores being sweated together to prevent oil running down inside the cable due to capillary action.

Mr. H. Bright referred to wiring in salt-water swimming baths where condensation was extremely bad, and there was also a salt laden atmosphere. He believed the alternatives were a metal-sheathed wire in a non-metallic conduit system, or some form of rubber-sheathed cable in a metallic system. Dr. Dunsheath said that if moisture could be kept away from the dielectric it did not matter much whether or not there was salt about. To meet bad conditions of that kind one must use the very best rubber cable possible, one which would

withstand oxidation, and then, if possible, seal the conduits.

Mr. J. R. Cowie was not quite sure whether copper made by a new process, as against that made by the electrolytic processes, would withstand bending tests. Dr. Dunsheath replied that if the mechanical properties were sufficient to enable a cable to be made they were certainly sufficient to carry it through its future life, though he did not think the new processes had an advantage over the old. Physical characteristics which made a new product a disadvantage in a machine might be of advantage in a conductor.

The Marx-type Rectifier

THE paper to which reference was made last week in which Dr. W. G. Thompson described how inward radial air flowing over the confronting surfaces of axially-opposed nozzle-shaped electrodes is employed to cool the arc in the Marx convertor was discussed at the Institution of Electrical Engineers in London on April 12th.

Dr. W. M. Thornton remarked that no new principle had been devised, but the particular combination employed had made the device practical. Whether endurance tests would cause the design to be modified remained to be seen; the experimental stage had, however, been passed and major development had commenced. The ignition circuit must be of equal reliability to that of the main plant. This type of rectifier had great possibilities and it would find a permanent place in several fields of application. Apart from high-voltage d.c. work, the principle might find immediate application for tapping high-voltage a.c. lines for supplying small villages.

Prof. J. T. Macgregor-Morris described the paper as a splendid contribution and an illustration of an arc which had been made to behave itself. Not enough attention had hitherto been given to arc stabilisation by passing a current of air through the arc itself. It was not clear how the main arc was started after the pilot discharge had stopped. He was pleased to note that the author appreciated the importance of preventing radio interference.

Mr. B. C. Goodlet said that this was the first paper on this subject to be read outside Germany. The Marx combination was a considerable achievement to which tribute must be paid. It had many advantages and could be made to do some things which the mercury-arc would not do, but time alone would show whether it would displace other types. The author dismissed inverted operation in a few lines, but this feature was the most important from the traction point of view. The need for the provision of auxiliary air, water, magnetic, and ignition services might limit application to the larger sizes.

A " Magnet " 9-kW tool-hardening furnace in the works of the United Steel Companies, Ltd. (See page 550)

Mr. W. E. Highfield remarked that when a new development took place it was often subjected to criticism in respect of comparatively minor details which were modifiable, and so did not receive fair play. He welcomed this paper as a piece of new thought which they had been privileged to hear for the first time. At the moment interest in rectification was intense, and was responsible for more inquiries and orders than any other branch of engineering. The Marx rectifier would probably not rival other types at the lower voltages, and so might be limited to h.v. applications for wireless uses, &c. Attempts were being made to lower the voltage, whereas makers of glass and steel-clad types were trying to raise their voltages. The two must clash somewhere, so there would be very keen rivalry. For rural work a combined rectifier and switch might have applications, while the Marx system might be the means of cheapening the h.v. d.c. grit-deposition method.

Dr. C. C. Garrard said the Marx device was not a rectifier proper, but rather a rapidly operating switch. It was a high-voltage device, the mercury-vapour rectifier being a medium-voltage device and the mercury-jet type a low-voltage device. They could be likened to switches of the knife, magnetic blow-out, and oil-immersed classes. The simplicity of the mechanical system of ignition appealed to him, but it was not easy to believe that heavy short circuits could be broken with so small an arc, which would mean that switchgear would not be needed. The large size of rectifier contemplated by the author indicated that the transmission of d.c. at high voltage would be reviewed in a new light. Easy control by means of the ignition system gave the Marx apparatus its importance.

Fruitful Field of Service

Mr. H. Rissik failed to see how this rectifier could operate at a good power factor. The cause of back-firing was the same as in other types, namely, persistent excess load. The most fruitful field for the Marx device would be h.v. d.c. work and tapping a.c. lines.

Mr. B. S. Gossling discussed the physical properties of electrode gaps and conduction in gases and vacuum. Although compressed air was present in the Marx rectifier, it might be said to create its own vacuum immediately it ignited. The difference between independent ignition and grid control was that the former was straightforward and once started would go on, whereas the latter was an " unbelievable " effect.

Mr. W. J. John said he had just returned from Brunswick where he formed the impression that some notable work had been done there. He was struck by the smallness of the main portion of the rectifier, but its auxiliaries appeared to be relatively large, though not so disproportionate as they might appear to be. A new method of ignition had been devised which was simpler and smaller than the original. The Marx rectifier would reduce the distance and amount of power at which h.v. d.c. transmission became economical, without introducing fresh problems. It was a notable invention which might have an important influence, and it had been developed very quickly in a college laboratory without the aid of commercial assistance or resources.

Dr. W. G. Thompson, in reply, referred to a communication sent to the meeting by the inventor in which he described an improved method of ignition by means of a third electrode. It could be made very compact and free from radio interference. The main arc was able to start after ignition had stopped because of the reduced density of the electrode gap caused by the h.f. impulses; this was clearly shown by the oscillograph. At the moment the worst feature was the arc voltage drop, but the fact that it had been reduced from 1,000 to 40 V in six months showed that progress was being made. He himself had seen a short-circuit current of 15,000 A broken by merely interrupting the ignition.

Electricity Meter Bearings

EXPERIENCE with, and problems relating to, bottom bearings in electricity meters are discussed in the paper by Mr. G. F. Shotter which was read before the Meter and Instrument Section of the Institution of Electrical Engineers in London on April 13th. The paper represents many years' work in the laboratories of the North Metropolitan Electric Power Co.

It first outlines the results obtained over a period of ten years with oiled sapphire-steel bearings in a single type of meter and describes tests carried out on new and worn pivots and jewels with various lubricants and abrasives. The results indicate that oil greatly increases the life of a bearing, but that, even when oiled or greasy jewels are used, the presence of rust or debris is the major cause of wear and consequent errors in the reading of the meter. A series of wear tests on various pivot materials, both oiled and dry, shows that materials of all hardnesses give comparatively good results when oiled. No conclusive evidence is obtained of the validity of Stott's theory that oxygen is set free from sapphire under the influence of the large cohesive forces.

The cause of surface cracking in sapphire jewels is then investigated, by means of a device which initiates impacts at the rate of eighteen per minute between the pivot and the jewel of a meter bearing. Finally, an account is given of apparatus designed for the rotational testing of meter bearings in air and inert atmospheres, providing special facilities for the microscopical examination of jewels during tests in nitrogen, argon, neon, hydrogen, and a vacuum.

In an appendix reference is made to further research since the paper was written which has shed considerable light on the problem of wear. Conclusions drawn from the whole of the experiments on oxide production are that in a dry oxygen atmosphere a black oxide of iron, and not the red, is produced; consequently, it follows that in the inert gas (free of oxygen and/or water vapour) and vacuum tests on sapphires black or red oxide should be produced if any oxygen is derived from the sapphires.

With one exception, neither black nor red oxide has been discovered in the sealed units using inert gases. This exception was the second hydrogen unit, which undoubtedly con-

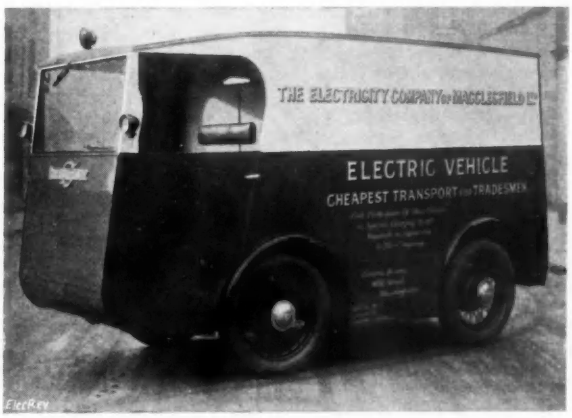
tained a trace of water vapour; but, in any case, this does not support the sapphire-oxygen theory, as the other sealed units did not contain the oxides. Perhaps the strongest argument against the theory is the vacuum unit, for the reason that when inert gases are used there is always a doubt as to the possibility of traces of oxygen and/or water vapour being present, whereas in the vacuum unit this possibility is reduced to the absolute minimum.

The author emphasises the very rapid rate of production of red or black oxide in the presence of oxygen and/or water vapour. As an example, the sapphire jewel cut with its optic axis parallel to the base plane mentioned in the paper produced rust after two and a quarter million revolutions in air. This should be compared with the vacuum unit, which has already done eighty million revolutions on a jewel having an unknown optic axis and is still running at the same or a greater speed. Again, a jewel produced rust in air after only 4,500 revolutions, whereas up to date this jewel in neon has done thirty million revolutions and there is no sign of either black or red oxide. It is running at practically the same speed as at the start, thus showing that the friction has not materially increased.

A New Theory

In experiments with steel-steel and diamond-steel combinations exactly the same results under the same conditions were obtained as with sapphire-steel, which seems to prove that rusting in the presence of oxygen and/or water vapour is independent of the sapphire. The same rapid rate of production of oxide and consequent increase in friction is to be noted. Consequently, it appears to the author that the sapphire-oxygen theory is untenable. Finally, it seems that the explanation of the production of the oxide of the pivot material has to be sought in the extreme activity of the particles produced during wear, particularly at high pressures, and it is possible that the formation of heat may also play a part in the phenomenon.

From his examination of all pivot materials tested, the author states a tentative theory as follows: in an atmosphere containing oxygen and/or water vapour, and where the bearing material is oxidisable, the product of wear is an oxide of the material. The particular oxide formed may depend on the pressure and/or speed. If this is true it will account satisfactorily for the results of all the experiments so far carried out. When steel is used for a bearing, with perfectly dry oxygen black oxide, and with only water vapour present, red oxide is produced. With oxygen and water vapour present, red oxide is again produced, and where dry oxygen and dry hydrogen are present in combination the major portion of the debris is red oxide. Other metals may also produce different oxides under similar conditions. The extreme difficulty of obtaining perfectly dry gases makes it necessary to keep the gas in contact with the "drier" for at least several weeks and as a final precaution to pass the gas slowly through liquid air.



An "Electricar" delivery van used by the Macclesfield showrooms

Remote Control Gear for Motors

THE automatic starting, control, and protection of motors from a distance are dealt with in the paper by Mr. H. Coates which was read before the ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS in London on April 10th.

It contained a résumé of development from the plain to the automatic starter, while the various requirements for push-button and automatic starting were explained. Reference was made to the special equipment needed for controlling printing presses, regulating marine machinery, dual control on board ship, water booster control for small village supplies, automatic lifts, the control of large electric furnaces, the special gear installed for regulating the steam re-heating process at the Dunston power station, and numerous other applications.

The control of machine tools is normally fairly simple and calls for little novelty.

Sometimes, however, a special proposition entails a good deal of development work and experimental study.

For a tracing or copying machine, for instance, the experimental work for which is still incomplete, the object desired is that an electrical tracer passing over the copy shall cause a reproduction in hard steel dies, through the medium of a milling cutter, of exactly similar shape.

The machine is fitted with five motors, one to drive the cutter, one to drive the work in a vertical plane, another in the horizontal plane, and another in the direction to or from the copy, in addition to the lubricating pump motor.

Each individual motor on the machine can be separately operated for aligning the cutter and tracer with the work and thereafter the die sinking operations are automatically controlled and profiling is semi-automatically controlled.

The tracer is completely enclosed and unaffected by dust or dirt, and the electrical connections are such that it makes circuit only and never breaks circuit on the slow moving contacts, while a direct-current supply at 25 volts is used for this operating circuit.

* * *

Electricity in Collieries

The increasing use of electrical machinery at British collieries was described by Mr. J. A. B. Horsley, H.M. Electrical Inspector of Mines, at a meeting of the South Wales branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS at Cardiff on April 14th.

Mr. Horsley said that the utilisation of electricity for working colliery plant was now fully recognised, and that steady progress in this direction had been maintained during the past five years. In that period there had been an annual general increase of 1,000 motors at work, representing 34,000 horse power. So far as South Wales was concerned, increases in the use of electrical machinery had been recorded in connection with haulage, both underground and on the surface. It was obvious that the nearer to the coal face electrical appliances were used the greater was the danger, but notwithstanding the increased use of electricity, particularly under the circumstances just described, the number of accidents remained at the old figure.

Light Signals—A Fresh Aspect

THE use of coloured beams of light for railway signalling, aerial and marine navigation, dock and harbour indication, &c., has practical limitations, since the fog-penetrating properties and general distinguishability of coloured lights leave much to be desired. This problem is being approached from a fresh angle by Mr. L. G. Toplis, of the Sinterae Illuminating Co., who has based his investigations on the known fact that the average impression made on the eye by a sustained beam of light is considerably inferior to the fleeting impression it receives of a blinking light, or flash of short duration. The phenomenon known as "persistence of vision" causes the initial momentary impression to be the maximum, while fatigue of the mechanism of sight probably accounts for the subsequent diminution.

Thus, a beam of light not ordinarily perceptible as such in fog becomes definitely visible when made intermittent by periodic obscuration at a suitable (low) frequency. Working on these lines, Mr. Toplis has developed a lantern housing two lamps of equal intensity with two circular apertures in front of the lamps. An internal obscuring disc, driven by a miniature motor which starts when the lamps are switched on, is pierced by a single circular hole, so that, when revolving, each lamp is revealed alternately. With the speed of the disc appropriately fixed to produce the correct frequency of alternate revelation of the two light sources, the eye is enabled to perceive the beam in a foggy atmosphere which would obscure a normally exposed lamp.

In addition to the fog-penetrating quality of this type of lantern, it has also been demonstrated to possess a definite directional aspect. The optical impression of the tangential direction of the flash is governed by the angular displacement of the twin apertures, varying according to whether they are in line vertically, horizontally, or at some intermediate angle. It thus becomes possible to dispense with the use of colours and to employ identical lanterns for signalling and directional indication merely by altering the orientation of the lantern.

Ice Production at Hull

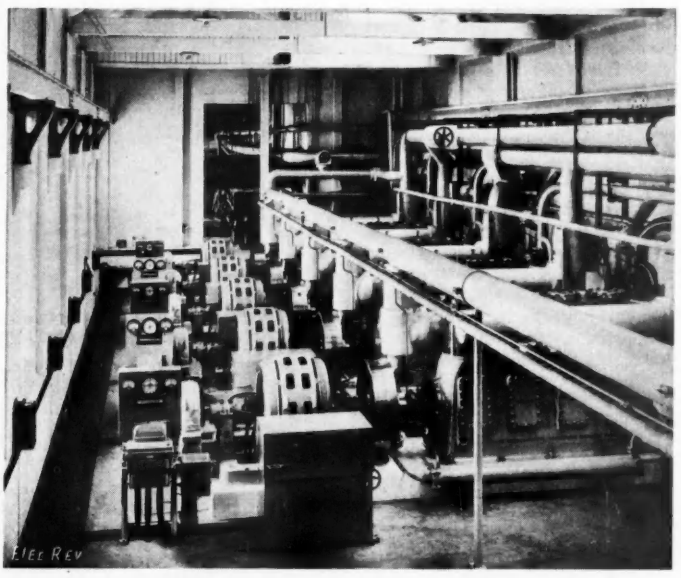
Re-equipment of a group of factories without interfering with their normal output

THE remodelling of five large factories in slightly over three months without interfering in any way with the normal output is a feat worthy of consideration. This formidable task was undertaken by the Hull Ice Co., Ltd., in order to increase the capacity of five of its eight factories by 299 tons to 695 tons per twenty-four hours. The total output of all its factories has thus been raised to over 1,000 tons per day, although one factory has been dismantled altogether and two others remain unaltered.

The work involved a radical change from belt-driven horizontal compressors to high-speed vertical single-acting sleeve-valve machines coupled direct to electric motors. They operate on the double-suction supercharging dry-compression principle with flooded shell and tube evaporators in the ice tanks controlled by float valves, the liquid ammonia refrigerant being precooled and the ice-can water fore-cooled through a primary evaporating system.

The ammonia mains and pipe connections throughout have been electrically welded on site. Each "Polar" totally enclosed quadruple monobloc compressor, supplied by the Liverpool Refrigeration Co., Ltd., is driven by a "Witton" three-phase, 50-cycle, 400-V synchronous induction motor rated at 380 b.h.p. at 375 r.p.m. Each motor is provided with two pedestal bearings with a third to carry the exciter at the end. Special precautions have been taken with the insulation, the windings of the motor being moulded in mica while the overhang is further protected by a special tape coated with a fume-resisting varnish. The full load efficiency of these motors at 0.9 p.f. is 92.5 per cent., and their starting torque is 100 times full-load torque with a starting current not exceeding 1½ times full-load current. They will withstand an overload of 25 per cent. for two hours.

Each is controlled by a G.E.C. liquid starter of 1,440 h.p on the minute rating and a control pillar, both mounted on the floor close to the motor they control and capable of starting three times in quick succession without becoming unduly hot. An interlocking switch prevents the stator oil circuit-breaker being closed before the dippers are completely withdrawn from the liquid. Each machine is provided with three overload trips on the feeder circuit-breakers and two overload and under-voltage trips on the motor control units.



The new engine-room at the Hull Ice Co.'s works, showing the five "Polar" compressors, each driven by a 380-h.p. motor

Each compressor unit is fitted with meters for measuring kilowatt-hours, power factor, line and exciter currents, recording ammeters, and stop and push-button controls at either end of each machine. Four 500-kVA step-down transformers, two in each sub-station, are electrically interlinked through circuit-breakers on both high- and low-voltage sides, ensuring the minimum amount of stoppage in case of breakdown.

The planning, organising and actual erection of the electrical installation were carried out by the Hull Ice Co.'s staff under the chief electrical engineer, Mr. S. Cooper. So successful is the plant that not only has the output increased, but at the same time there has been an average reduction in the energy consumption per ton. During the past two months the factories' approximate output has been 4,000 tons per week with an average total consumption of 25 kWh per ton of ice "all in." With all eight factories on full output the company now manufactures over 1,000 tons of ice per day.

Simpler Radio Reception

THE unusual method of receiving radio signals which has been devised by the *Wireless World* represents an important advance in design. The set, which was demonstrated in London last week for the first time, does not incorporate anything fundamentally new; the novelty of the achievement consists in the particular combination of a set of effects, which, though known, have hitherto been of little utility, in such a manner as to endow them with considerable practical value. This "Single-Span" receiver, as it has been designated for identification purposes, abolishes the switch usually needed to change over from the medium to the long wavebands, thus covering all the European broadcasting stations with one sweep of the tuning dial. The principle employed minimises complication, reduces the cost and intricacy of construction, and affords greater reliability by eliminating the need for ganged condensers and matched coils, with the delicate, and therefore costly, adjustments which these entail.

"Single-Span" receiver chassis and power unit

The new receiver is a superheterodyne, but has no signal-frequency tuned circuits. The oscillator condenser is the only tuning control. The unique feature of the system is the combination of an intermediate frequency (of the order of 1,600 kc/s) higher than that of the received signal with a special untuned aerial coupling system. This makes it possible to cover the entire waveband from 200 to 2,000 metres with a miniature condenser of only 0.00016 mfd. capacity. Tuning is unaffected by aerial characteristics and the aerial system is aperiodic (*i.e.*, equally responsive to all wavelengths) over the 200 to 2,000 metres range, but rejects all signals outside this band.

Perhaps the greatest boon of all is the elimination of forms of interference and whistles common to ordinary superheterodynes, since there cannot be any second-channel or similar forms of interference.

There is the added possibility of obtaining, by means of an uncommon type of intermediate-frequency amplifier, variable selectivity depending upon reception conditions from any particular transmitter. This, in turn, tends to provide better quality of reproduction.

While the chief use of this new principle of design will no doubt be for broadcast reception, it is likely to find numerous special applications, particularly when freedom from complication and faulty contacts are of major importance.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

More Flex Wanted

On reading the description of the "Solon" waffler in your issue of April 6th, I note that, as is usually the case with most electrical appliances, it is fitted with 6 ft. of flexible cable. Having some experience with an all-electric house, where wall plugs are used and not bayonet holders from the light, I nearly always find that 6 ft. of flex is insufficient, often bringing the appliance only just to the edge of the table without even allowing the wire to rest on the floor.

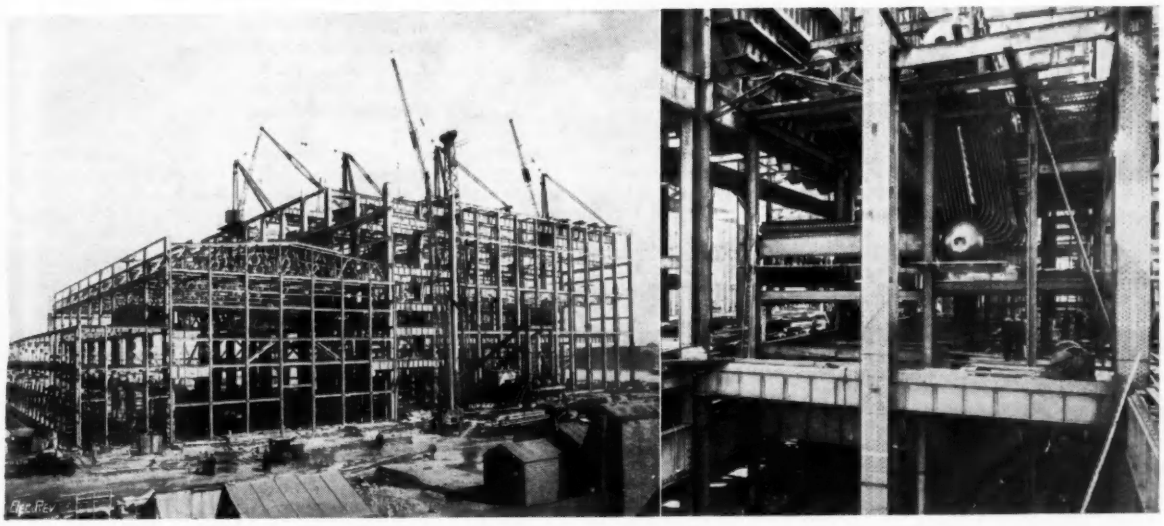
The height of a table is about 2½ ft., and 6 ft. of wire only allows 3½ ft. from the wall to the edge of the table. Even if the appliance just goes on to the table, the slightest tug on the wire will pull it on to the ground. It would surely be more satisfactory, and would cost the manufacturer only about 2d. more, to supply all appliances with 3 yds. of flexible cable. Those users not requiring it could easily cut off the unwanted portion, which is simpler and less costly than having to buy a further 3 yds. and taking off the old and putting on the new.

It is the same with electric fires. These are supposed to have 6 ft. of flexible cable, but on many of mine there is not more than 5 ft. from the outlet, and in one case only about 4½ ft. No doubt 6-ft. lengths are measured off at the factory, but a certain amount of it is inside the housing of the fire, and several inches are used up in connecting it to the terminals and plug. In any case, 6 ft. is not sufficient in many cases, especially in a large room, depending on the position of the plug and where the fire is required. I have two plugs in some of my rooms, and yet find that 6 ft. (or 5 ft.) is not satisfactory.

For what reason have manufacturers hit upon the arbitrary length of 6 ft. as standard? Perhaps the B.S.I. might consider the matter.

D. V. ONSLOW, A.M.I.E.E.

Pinner, *April 11th.*



Good progress is being made with the erection of the new Fulham power station, which was commenced in August last; the steel framework is now almost complete. Left: General view of the station. Right: Corner of the boiler house

The Argentine Radio Market

Referring to your note in the ELECTRICAL REVIEW of February 16th regarding radio apparatus sold in this country, I am pleased to report that the business of the British manufacturers is improving. Whereas in 1931 it was only 5.2 per cent., in 1932 it was 8.5 per cent. Although the 1933 figures are not yet complete, these should again show an increase.

The Marconi Wireless Telegraph Co. has now appointed as its agents a company which hitherto had done a large business with American apparatus.

The General Electric Co., Ltd., also is increasing its sales of British-made apparatus and anticipates doing a very large trade in its new Catkin valves.

The Marconi Co. was also the contractor for the newest broadcasting transmission station in Buenos Aires, L.R.5.

Wireless apparatus was the highest in value of all electrical imports, amounting to over $3,000,000 paper, equal to approximately £200,000, not including valves.

Importers of British apparatus now have an advantage in obtaining the necessary foreign exchange owing to Great Britain's large purchase of Argentine exports, giving a sufficient balance of exchange. On the other hand, Germans and Americans are handicapped by having to pay 10 per cent. to 15 per cent. higher rates through having to buy their exchange on the outside market.

H. O. SIDDELEY, *Delegado*,
The British Electrical and Allied Manufacturers Association.

Buenos Aires,
March 21st, 1934.

Power Factor of Neon Signs

Mr. Russell's concern at the thought of the supply undertaking suffering losses leaves me unmoved, and he has unfortunately contributed nothing constructive towards my enlightenment.

Supply authorities usually ask large users to maintain their power factor at or above 0.80 lagging. I know of many industrial concerns where the power factor has been corrected from 0.60 and thereabouts to 0.80 and upwards by static condensers, to escape penalty and/or earn bonus. Many individual units in such plants operate at power factor as low as, and probably lower than, neon signs. But when the overall power factor—often recorded on a sine meter—is above the standard of 0.80, the undertaking would never dare approach these users and demand that the individual units operating at very low power factor be corrected to 0.80, irrespective of the overall figure.

In my opinion it is a most unfair—and usually successful—"try-on" with shopkeepers, who seldom have a technical engineer on their staff to make a firm stand for them. The problem can be stated under two heads:—(1) The common-sense or common-decency view. Should there be any need to pick out individual units with low power factor, if there are units on the installation operating at 0.90 and better, which maintain the overall standard at 0.80? Remember I speak of a sign used only when other lighting is used and at no time does the installation fall below 0.80 lagging.

(2) The legal view. Well, what is it, I wonder? And can anyone kindly guide me on this? Can any fair-minded man connected with the supply side justify the action taken.

I agree, of course (and anyone would), that a person using a neon sign and nothing else, causing the overall power factor to be lower than the minimum stipulated value, ought to be called upon to correct power factor. That's entirely different.

April 14th. PLUMBER.

Suburban Railway Electrification

It is interesting to hear that the L.N.E.R. have nearly completed what is to be the largest new steam locomotive in this country.

This is spectacular, but from my knowledge of this country more people are interested in having an electrified service to

Chingford, Woodford and Wanstead. London is not spreading as fast in this direction as in others owing to the lack of travelling facilities. Grandfathers remember the time when railway electrification for this area was first discussed. For years the L.N.E.R. new signalling reports have contained the words "pending electrification."

Has a circular train route of about ten miles radius, complete with spoke routes, with the city as a centre ever been considered? A linking up of existing routes is all that is needed. There is a growing demand for eliminating the need to journey up to a London terminus in order to cross from one suburb to another.

Leyton, E.10, *April 14th.* W. Penstone.

Prepayment Meters

I am sincerely indebted to Mr. E. H. Miller for his timely warning as to the dire consequences awaiting my half-sovereign, should I still be fortunate enough to possess one. Frankly the idea had never occurred to me before. The thought to a Scotsman of losing such wealth in a multi-coin slot in exchange for sixpenny worth of juice might be so alarming as to drive him back to candles. Whatever would the E.D.A. say? I fully appreciate the guilty conscience which may have prompted Mr. Miller's epilogue, but, with due respect, may I suggest "rumour" is a sandy soil upon which to base conclusions. A. Page.

London, S.W.16, *April 14th.*

Contractors and Supply Authorities

I was very interested in the letter from "Small Contractor" in your issue of March 9th, also in that of "Another Contractor" on March 30th.

For some time I have been trying to find an association that will look after the interests of the electrical contractors.

I consider that the E.C.A. has let the contractors down very badly by allowing the supply companies to take over the majority of the contracting work.

I find that the National Register includes a large number of supply undertakings; we cannot therefore look to them for support.

I also note that the National Register has increased its subscription to £2 2s. per annum to meet the cost of additional inspectors. Could not this work be left to the inspectors employed by the supply companies? And are not the members to be trusted to maintain their principles?

Will any member answer the following questions?—

(1) What support does the E.C.A. or the National Register give to its members who are threatened with competition by the supply companies?

(2) How many supply companies are on the National Register?

(3) How many supply companies are doing their own installation work? And would they be worried even if the National inspectors were to condemn their work?

To my mind, this is all leading to nationalisation of the electrical industry, and not only will the contractors be forced out of business, but the E.C.A. and the National Register will have to go with them.

We do not allow the manufacturers of fittings, or the factors, to do contracting work. Then why allow the privilege to the manufacturers of electricity?

Is there any organisation pledged to fight this menace? If so, let us know so that we may all join at once.

April 16th, 1934. A Sufferer.

New Books

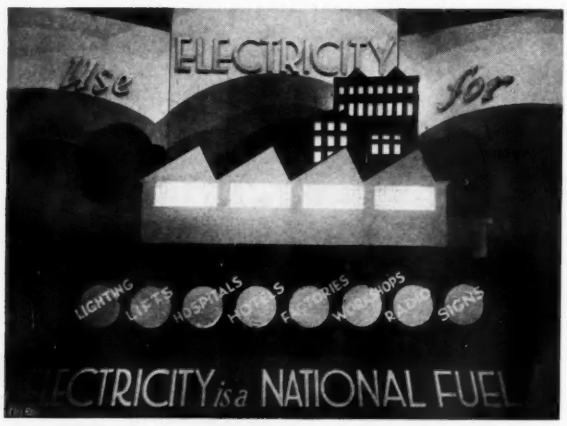
Short Wave Wireless Communication. By A. W. Ladner and C. R. Stoner. Pp. 396; figs. 215 and 12 plates. London: Chapman & Hall, Ltd. Price 15s.

This is the second edition of a book which was first published in November, 1932, and it still remains, so far as we are aware, the only textbook which is devoted solely to short-wave working. Both authors have been closely identified with the instructional and research departments of the Marconi Company. The book has been brought up to date by the addition of some thirty-six pages, a witness to the rate at which short-wave technique is advancing. The whole field of communication is dealt with, transmitters, wave propagation and receivers, both from the theoretical side, using simple mathematics, and from the practical side. There is, too, a chapter on the development of short waves from the historical aspect, and one on the latest developments in ultra-short-wave working.

The practice of the Marconi Company naturally takes foremost place, but there are excellent lists of references to articles and papers at the end of each chapter so that the reader can follow up any special points on which he requires fuller information than it is possible to give in the book.

Kunstharzpressstoffe. By W. Mehdorn. Pp. 138; figs. 149. Berlin: V.D.I. Verlag. Price Rm. 8.75.

Considering the great importance of moulding compounds of the artificial or synthetic resin type in innumerable applications where wood, metal, and porcelain were formerly employed there has hitherto been surprisingly little literature on the subject. The present volume is eminently practical in scope and should certainly be studied by everyone concerned with the industrial uses of moulding materials for any purposes.



A model showroom display in Dublin by the I.F.S. Electricity Board

Commencing with a survey of the general nature and applications of synthetic compounds of all kinds, the author deals fully with the classification of synthetic resins, and explains the various methods of moulding employed. Typical machines are illustrated, and the characteristic features of the moulding operation, choice of method, hardening periods, and finishing operations are discussed. The information given on design is particularly important from the standpoints of economy in moulds, simplicity of operation, and durability of product; also as regards the moulding-in of metal parts. Extensive collections of data are presented concerning the chemical, electrical, mechanical and other physical properties of different compounds, including notes on the behaviour of the different materials when exposed to heat, moisture and various reagents.

A short but valuable section on economic considerations is followed by illustrated notes on a great variety of moulded products. Though many of the applications are of a mechanical nature, all the principal uses of moulded parts in electrical equipment are covered, and the electrical properties and testing of the materials and products are dealt with very thoroughly. The book is authoritative, reveals many opportunities for economy, and should do much to avert costly mistakes.

* * *

Shorter Notices

The "Handy Colliery Guide and Directory," for Northumberland, Durham, Yorkshire, Cumberland, and Westmorland, has been issued by Andrew Reid & Co. at 2s. 6d. It contains, among other sections, the usual map showing collieries and railways, and a list of collieries, colliery owners, agents, managers, and engineers, with addresses.

"Industrial Psychology Applied to the Office," by W. S. Raphael, C. B. Frisby and L. I. Hunt. Pp. 95. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d.

"Handbook of Technical Instructions for Wireless Telegraphists," by H. M. Dowsett. Pp. 566; figs. 525. London: Iliffe & Sons Ltd. Price 15s.

"Alternating Currents" (2nd edition), by A. E. Clayton. Pp. 340; figs. 383. London: Longmans Green & Co., Ltd. Price 10s. 6d.

"Principles of Radio" (2nd Edition), by K. Henney. Pp. 505; figs. 311. Price 21s. 6d. "Short-Wave Wireless Communication" (2nd Edition), by A. W. Ladner and C. R. Stoner. Pp. 394; figs 215. Price 15s. London: Chapman & Hall, Ltd.

"Industrial Accountancy," by H. A. Simpson. London: Longmans. Price 10s. 6d.

"Classified Examples in Electrical Engineering," by S. G. Monk. Vol. II, Alternating Current. Pp. 163; figs. 11. Price 3s. 6d. "First Year Engineering Science: Mechanical and Technical," by G. W. Bird. Pp. 164; figs. 117. Price 5s.

"Planning, Estimating and Ratefixing," by A. C. Whitehead. Pp. 332; figs. 59. London: Sir Isaac Pitman & Sons. Price 10s. 6d.

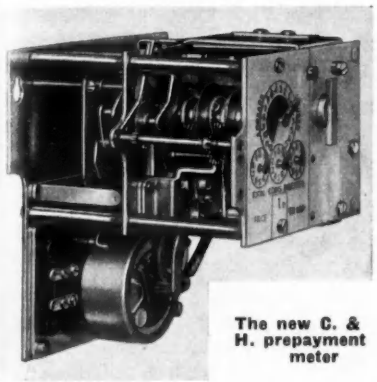
"Physical Constants," by W. H. J. Childs. Pp. 85; figs. 7. London: Methuen & Co. Price 2s. 6d.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Two-part Tariff Meter

The two-part tariff prepayment meter of MESSRS. CHAMBERLAIN & HOOKHAM, LTD., Birmingham, is a modification of the company's ordinary prepayment meter by the addition of a synchronous motor. This motor runs continuously and drives by gearing the prepayment mechanism in the same direction as the meter at a rate determined by the standing charge.

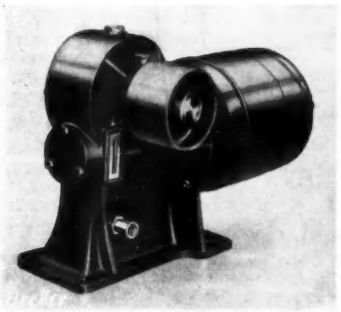


The new C. & H. prepayment meter

The insertion of the coin corresponding to the standing charge closes a switch; should no energy be taken within a definite period the switch opens. If energy be taken, the rate at which the mechanism runs down will be accelerated in proportion to the consumption and the switch will open correspondingly earlier. If another coin is not then inserted, the motor will continue to run and register arrears, but even if arrears are shown the consumer can obtain a limited supply by putting in a coin; *e.g.*, a shilling will provide threepennyworth of electricity and cancel ninepence of the debt, but if current is not used immediately the whole value of the coin is automatically transferred to arrears. The effect is that the consumer can pay off his arrears by instalments instead of in a lump sum.

Small Geared Motor Units

The range of fractional horse-power motors manufactured by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has been extended by the addition of low-speed worm-geared units, which are made in sizes from ½ to 1 h.p. to operate on d.c. or single-phase a.c. circuits (split-phase or repulsion-start induction) at voltages between 100 and 250 V. The initial speed of the motor is 1,425 r.p.m., but gears for a final shaft speed as low as 50 r.p.m. can be supplied.



A 1-h.p., 50-r.p.m. geared motor unit

The gears are of the single-worm oil-immersed reduction type, and are enclosed in a close-grained grey iron casing, the whole being oil-tight and dust-proof. An oil reservoir drain plug and indicating gauge are fitted.

The worm shaft is of nickel alloy steel, and is fitted with double-purpose ball bearings designed to take the full radial and thrust loads. The end cap, through which the worm-shaft projects, is furnished with a packing gland to prevent oil leakage from the gear box. The worm and shaft are integral; the worm runs in an oil bath and the shaft is directly coupled to the rotor, no flange or flexible coupling being employed. The worm-wheel is of phosphor bronze and is mounted on a steel shaft running in phosphor bronze bearings lubricated from Stauffer grease cups.

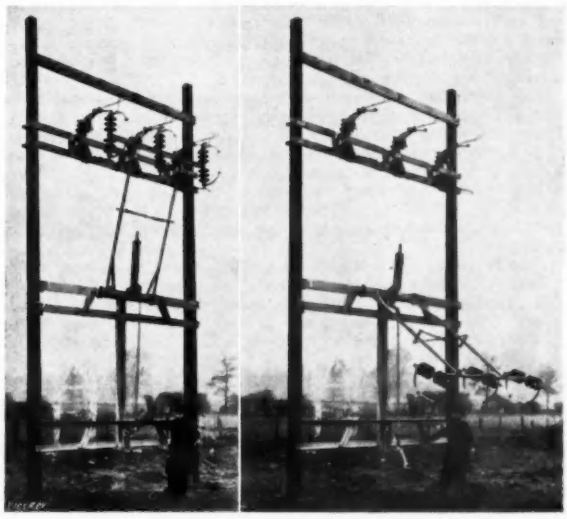
The low-speed driving shaft normally projects on the right-hand side of the gear casing when viewed from the gear end; but for specific orders the shaft can be extended on the left-hand side, or both, as required. By withdrawing six hexagon-headed screws the gear-case cover can be completely removed. The gear box is not split across the centre line of the low-speed shaft.

A 33-kV Pull-down Switch-fuse

The "S.E." 33-kV pull-down switch-fuse introduced by SWITCHGEAR & EQUIPMENT, LTD., 49, Queen Victoria Street, E.C.4, employs the same counterbalancing device as that supplied for the company's 11-kV switch-fuse. The use of a single compression spring and cam eliminates the need for wire ropes, pulleys, winches and counterweights, and avoids danger to the operator.

In the "S.E." design the contacts are of the high-pressure self-aligning type, each with a simple means of independent adjustment over a wide range, by which compensation can be made for inaccuracies in erection or for later settling or warping of the structure. The moving frame is of drawn-steel tubing with welded joints. The arc-over values of the insulators are 140 kV dry and 110 kV wet.

A 33-kV switch-fuse has been designed for mounting on two vertical supports at 13-ft. centres with 4 ft. between phases,



The "S.E." 33-kV switch fuse, closed and open

the fuses being raised and lowered by a handle at the foot of the structure.

Rectifiers for D.C. Mains Receivers

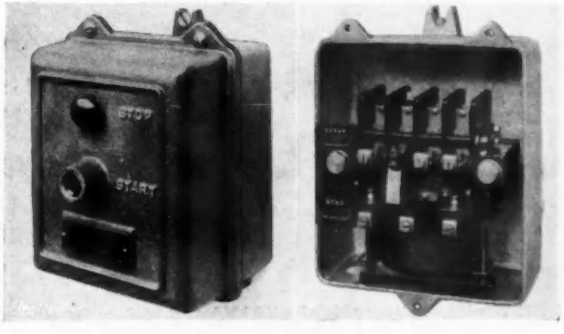
A new rectifier has recently been marketed by PHILIPS INDUSTRIAL, 145, Charing Cross Road, W.C.2, for use with d.c. sets on a.c. mains. It has been necessary to construct two types on account of the considerable variation between the consumption of different sets. Of course, the rectifiers are so constructed that the set is supplied with the same value of d.c. as before.

A rectifier for d.c. receivers

Although most d.c. all-mains sets have their own smoothing circuit, the rectifiers themselves incorporate an unusually generous degree of smoothing, comprising two electrolytic condensers, each of 16-mF. capacity, and a large choke. The smaller type of rectifier is constructed for sets consuming between 115 and 150 mA, and the larger for 240 to 300 mA, the respective prices being £6 10s. and £8 10s.

A Straight-on Motor Starter

Several new features have been incorporated in the design of the new Type A235 a.c. push-button "straight-on" starter produced by M. & C. SWITCHGEAR, LTD., Kelvinside Works, Kirkintilloch, Glasgow. It is of smaller capacity than Type A219, being capable of starting motors up to 3 h.p. at 220 V.



The new M. & C. straight-on starter

up to 5 h.p. at 440 V, and up to 7.5 h.p. at 660 V, provided the standstill current does not exceed 50 A.

The three-phase contactor operates vertically and "start" and "stop" contacts are incorporated in the main assembly; only the push buttons are assembled in the cover, and there are no flexible connections. The complete unit can be withdrawn by removing two screws, and all terminals are at the front and easily accessible.

D

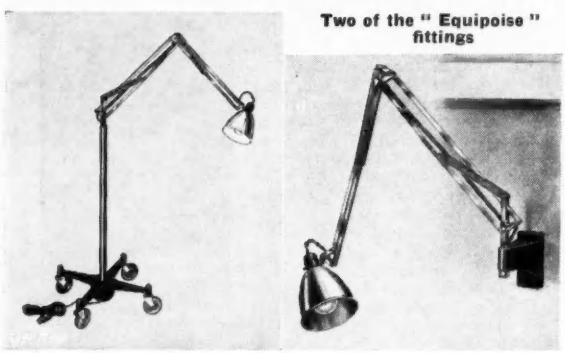
The contactor has four identical sets of contacts, three for the main current and one for maintaining the contactor operating coil circuit. The fixed contacts are of heavy-section copper supported by double springs and the self-aligning moving contacts are of tubular copper arranged to give a good scrubbing action. The unit is assembled on a moulded bakelite base with moulded arc shields between each set of contacts. The contactor is operated by the vertical lift of a self-aligning armature mounted below the contacts, thus giving maximum accessibility and compact design. The special self-aligning arrangement of the armature and properly proportioned shading rings ensure quiet operation.

The overcurrent trips in two phases are of the thermal type and self-resetting, both trips being adjustable simultaneously. There are three positions of the adjustor, giving a variation of 40 per cent. in tripping values. The bi-metals operate with a snap action in both directions and are automatically reset within 30 seconds after an overload has occurred. The releases give a time lag in inverse proportion to the value of the overload, and the operating values are unaffected by repeated operation.

Undervoltage protection is inherent in the contactor. The "start"-"stop" push button rods are mounted in the cover and actuate contacts which are fitted on the contactor unit itself. The case and cover are of cast iron, with clear holes at top and bottom for ¾-in. conduit; special cable supports are provided and very liberal space is allowed for wiring.

All-angle Lighting Fittings

A series of three useful adjustable lighting fittings has been introduced by Messrs. Herbert Terry & Sons, Ltd., Redditch. These "Equipoise" fittings are so constructed as to "stay put" in any position without the necessity of clamps of any kind. This feature is due to the use of two pairs of special springs, one within each main section of the movable arm. We illustrate two of the new fittings. The left-hand one is mounted on a small trolley with rubber-tyred wheels and should be very suitable for surgery use, among many other applications. The right-hand fitting is designed for wall mounting. The third (not illustrated) has a base which is heavy enough to allow of the fitting being extended horizontally to its full length without overbalancing. The price of the trolley pattern is £5 15s. 6d.; the others cost 4 guineas.



Two of the "Equipoise" fittings

A Draw-out Gate-end Starter

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester, have developed an air-break flameproof motor starter on the draw-out principle for use in mines. The connections between the incoming feeder and the busbar chamber are of the plug-in type, and the gear is fully interlocked. The overall height is 2 ft. and the cable connections are brought in as near the top as possible. Starting and stopping is by remote control from the coal-face machine, but the supply can be interrupted locally by resetting the trip contacts in the off position.

The Williams-Rowley system of earth-circuit protection is employed. When the switch is used for operating a coal cutter, the three-phase lines are run from the plug-in sockets of the busbar chamber through the blow-out coils, the switch contacts and overload trips to the power cores in the outgoing trailing cable; at the other end of which the cores are connected to the motor reversing switch. In the contactor a single-phase potential transformer is connected across the supply mains through fuses which also protect the main contactor coil. One side of the p.t. secondary is earthed and the other passes through the coils of the protective and operating relays, and is connected to the pilot core of the outgoing trailing cable.

When the machine switch is closed the pilot is connected to earth at the coal-cutter end through two resistances in series. On closing the coal-cutter switch, as the contacts leave the off position, one of the resistances is shorted by auxiliary contacts until the switch is fully closed. The temporary increase in current is large enough to close the operating relay and the reduced current with both resistances in circuit is sufficient to hold it in position. When opening the switch, as the contacts are brought to the off position, the pilot circuit is broken, tripping the operating relay and cutting off the supply to the main contactor coil. This sequence occurs in either direction of the rotation of the coal-cutter switch and the main contacts in the latter close before and open after the contactor switch closes and opens, the machine switch thus acting merely as a reversing isolator.

The draw-out gate-end starter photographed in position

Under sustained overload a coil or thermal element in each phase closes an auxiliary switch which, by earthing the pilot through a resistance, causes the protective relay to cut off the supply to the potential transformer and the operating relay to fall into the off position. If the two resistances are shorted by a fault between the pilot and earth, the increase in current will cause the protective relay to operate. Multi-way control can also be arranged, *e.g.*, for a shaker-conveyor drive, without the use of an additional pilot.

A Special Flexible Cord

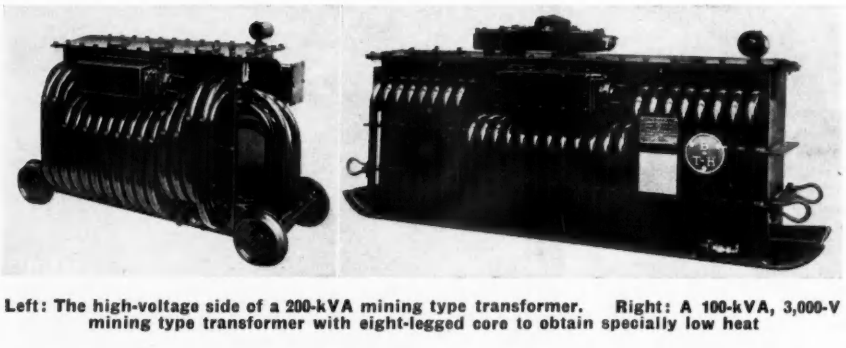
British Insulated Cables, Ltd., Prescot, Lancs, has recently produced a specially finished "Rockbestos" brand flexible, which has been specifically designed for use in short lengths as leads to small motors working in a slightly acid-laden atmosphere. The flexible consists of 40/.0076 in. tinned soft copper strand, insulated with a fine "Rockbestos" felting braided with asbestos yarn, and finished overall with a special enamel which is resistant to sulphuric acid.

Mining Type Transformers

Mining type transformers supplied by the British Thomson-Houston Co., Ltd., Rugby, for installation in non-danger zones have the underbase of the tank extended for protection, and haulage lugs or holes are provided at each end. The tank is reinforced and its cover is sloped to prevent the accumulation of moisture. Flanged wheels can be arranged to suit any particular rail gauge; they are readily removable and the underbase can then be used as a skid.

Welded steel cable boxes are used for superior mechanical strength, and the clearances are such that the boxes may be used without compound. The neutral point terminal is contained in a separate protective casing and connection to earth may be made either directly or through a neutral earthing device, by means of a link which can be easily removed when earth leakage tests are to be made. The oil gauge is flush to minimise accidental breakage, while the special breather is so constructed as to prevent the entry of coal dust into the tank; an oil drain valve is provided.

Limitations have been met, especially with regard to height, by the use of an eight-legged core, a patented form of construction. The company has also supplied flameproof transformers with wide flange tanks for single-phase outputs of not more than 5 kVA, and three-phase outputs of not more than 3 kVA for use in danger zones.



Left: The high-voltage side of a 200-kVA mining type transformer. Right: A 100-kVA, 3,000-V mining type transformer with eight-legged core to obtain specially low heat

British Overseas Electrical Trade

After the encouraging improvement in both the electrical import and export trade during recent months, the figures published by the Board of Trade relating to March are at first sight rather disappointing. Although imports show a substantial advance, the value of exports was £16,672 below the figure for the corresponding month last year. A perusal of the "destination" table below reveals, however, that this decline can be attributed almost entirely to a large falling off in the purchases of electrical machinery by Russia, and that in most other sections of the market the headway made in the preceding months is more than maintained.

For the first three months the value of electrical exports increased by £300,350 and that of imports by £79,617.

The destinations of four of the principal classifications of exports are given in the table below, but the following brief analysis of a few of the smaller export items is also of interest:—

Destination of rubber insulated electric wires and cables (not telegraph or telephone) during March, 1934, with the March, 1933, figures in parentheses: South Africa, £18,719 (£11,379); British India, £18,801 (£24,081); Australia, £13,456 (£13,977); New Zealand, £3,066 (£2,521); other British countries, £10,267 (£8,230); foreign countries, £8,001 (£6,445).

Insulated electric wires and cables (insulation other than rubber); South Africa, £20,021 (£7,326); British India, £14,954 (£4,501); Australia, £6,871 (£5,743); other British countries, £6,586 (£2,734); foreign countries, £5,758 (£1,552).

Telegraph and telephone apparatus (not radio): South Africa, £15,301 (£20,048); Australia, £14,440 (£7,276); Canada, £812 (£615); other British countries, £12,074 (£11,537); Argentina, £15,268 (£2,051); other foreign countries, £30,616 (£70,672).

The imports of electrical goods and apparatus came from the following countries (March, 1933, figures in parentheses): British countries, £9,342 (£7,442); Germany, £67,392 (£55,830); Netherlands, £37,158 (£25,189); Belgium, £6,403 (£3,599); France, £6,643 (£10,213); Switzerland, £12,738 (£9,735); Austria, £6,753 (£7,511); United States, £45,028 (£38,239); other foreign countries, £26,396 (£14,729).

Electric vacuum cleaners were purchased from: Canada, £2,365 (£24,637); other British countries, £4 (nil); Sweden, £7,330 (£2,764); Germany, £669 (£1,300); United States, £1,781 (£1,360); other foreign countries, £1,680 (£317).

EXPORTS AND IMPORTS DURING MARCH

	Exports. March, 1934.	Exports. Inc. or dec. as compared with March, 1933.	Imports. March, 1934.	Imports. Inc. or dec. as compared with March, 1933.
Submarine telegraph and telephone wires and cables	£4,519	+ £1,358	*	
Telegraph and telephone wires and cables (not submarine)	21,411	+ 2,568	*	
Other insulated wires and cables	126,500	+ 28,011	£18,874	+ £5,933
Radio receivers (excluding valves)	24,322	+ 6,819	15,371	+ 6,398
Radio transmitters (excluding valves)	31,860	— 6,409	*	
Radio valves	27,868	+ 99	16,500	+ 2,368
Other radio parts and accessories	35,898	+ 1,371	35,264	+ 11,158
Telegraph and telephone apparatus (other than radio)	88,511	— 23,688	*	
Elec. carbons	*		12,661	+ 1,457
Incandescent lamps	36,140	— 1,353	21,586	— 9,074
Other lighting apparatus	33,465	+ 9,304	21,105	— 780
Primary batteries	14,099	— 2,603	605	— 567
Accumulators	43,750	+ 4,444	*	
House service meters	11,185	+ 1,160	27,973	+ 2,646
Other elec. instruments	12,958	— 727		
Unenumerated elec. goods and apparatus	104,427	+ 28,026	47,914	+ 7,679
Elec. generators up to 200 kW.	18,927	+ 8,837	*	
Elec. generators, over 200 kW.	18,405	— 18,895	*	
Elec. motors	70,202	— 43,639	†17,433	+ 6,859
Convertors and transformers	45,957	+ 22,528	*	
Starting and controlling gear for elec. motors	21,020	+ 398	*	
Switch gear	64,840	— 29,970	*	
Other elec. machinery	11,220	— 4 311	7,543	— 3,418
Elec. vacuum cleaners	*		13,829	— 16,549
	£867,484	— £16,672	£256,658	+ £32,258

* Not classified separately. † Not railway and tramway motors.

Re-exports of electrical goods and apparatus in March totalled £8,413, which compares with £9,678 for March, 1933.

BRITISH ELECTRICAL EXPORTS DURING MARCH

Destination.	Exports of electrical goods and apparatus in March, 1934.	Inc. or dec. as compared with March, 1933.	Exports of elec. generators in March, 1934.	Inc. or dec. as compared with March, 1933.	Exports of elec. motors in March, 1934.	Inc. or dec. as compared with March, 1933.	Exports of other elec. machinery in March, 1934.	Inc. or dec. as compared with March, 1933.
Irish Free State	£20,270	— £3,375	*		*		*	
Union of South Africa	102,514	+ 25,701	£6,307	+ £5,942	£9,173	+ £1,897	£35,333	— £17,050
British India	92,420	+ 19,221	7,384	+ 2,183	9,204	— 2,650	36,968	+ 12,921
British Malaya	10,050	— 807	*		*		3,372	— 1,405
Ceylon	4,162	+ 492	*		*		*	
Hong Kong	5,444	— 2,212	*		*		*	
Australia	66,704	+ 15,360	2,401	— 2,119	4,814	+ 2,201	3,884	— 1,950
New Zealand	33,877	+ 4 933	*		2,325	+ 730	6,730	+ 2,016
Canada	4,165	+ 1,191	543	+ 81	1,476	+ 704	2,953	+ 2,203
Other British Countries	49,985	+ 17,430	1,805	— 1,408	8,236	+ 1,000	13,495	— 589
Sweden	9,238	+ 1,601	*		*		*	
Denmark	6,446	— 6,260	*		*		*	
Belgium	10,459	— 341	*		*		*	
France	13,124	+ 3,113	*		*		1,246	— 2,553
Spain	5,234	— 2,816	*		*		*	
Italy	6,033	— 28,272	*		*		*	
Greece	2,181	— 191	*		*		*	
Egypt	11,897	— 1,736	*		*		1,176	— 7,689
China	7,436	+ 1,902	*		*		8,294	+ 6,959
United States	2,042	— 4,980	*		*		*	
Argentina	30,420	+ 17,412	*		1,450	+ 310	1,581	— 1,757
Russia	*		—	— 33,522	1,041	— 68,822	450	— 13,747
Netherlands	*		4,987	+ 4,541	*		1,273	+ 744
Other Foreign Countries	122,812	— 8,986	13,905	+ 10,006	32,483	+ 20,991	26,282	+ 10,542
Total	£616,913	+ £48,380	£37,332	— £10,058	£70,202	— £43,639	£143,037	— £11,355

* Not classified separately.

Electrical Exhibitions

The first electrical exhibition, organised by the Electricity Department, on behalf of the West Bromwich Corporation, was formally opened on Monday last by the Mayor (Mr. C. B. Adams). The equipment was almost entirely for domestic use, and included electric cookers and heaters, immersion heaters, various types of water heaters, and some excellent examples of electric lighting fittings. A number of the leading makers were represented. Opportunity was taken of the occasion to demonstrate the advantages of the hire-purchase system. Ald. J. Bell, chairman of the Electricity Committee, who presided at the opening ceremony, referred with satisfaction to the progress made by the Department, particularly during the past ten years. This development was largely due to the application of electricity for industrial purposes, and it was hoped that the present campaign in which special attention was directed to the advantages of the use of electricity in the home would give a stimulus to this side of the undertaking. Considerable headway had already been made. In 1924 the output of the undertaking was 10 million kWh, and this year it had increased to 22 million kWh. Progress was being further accelerated, for last year there was an increase over the previous twelve months of three million kWh. The average cost per kWh had been reduced from 1.8d. to 1.1d.

The exhibition (which was arranged by Mr. W. A. Jackson, borough electrical engineer) will remain open until April 21st, and a programme has been arranged for each day. The special attractions include an all-electric kitchen and bathroom. The exhibitors are as follows:—Messrs. Belling & Co.; Berry's Electric, Ltd.; Falk, Stadelmann & Co., Ltd.; Electric Fires, Ltd.; General Electric Co., Ltd.; Hoover, Ltd.; Hotpoint Electric Appliance Co., Ltd.; Johnson & Phillips, Ltd.; Modern Washways, Ltd.; Revo Electrical Co., Ltd.; Simplex Electric Co., Ltd.; and Singer Sewing Machine Co., Ltd.

Organised by the Lighting Service Bureau in conjunction with the Stalybridge, Hyde, Mossley and Dukinfield Joint Tramways and Electricity Board, an exhibition of modern lighting fittings was held recently as part of a campaign to popularise electric light as a sales force. The exhibition, demonstrations and lectures were open to the public and were well supported. The exterior of the hall where the demonstrations were given was floodlighted on the two days of the event.

Parliamentary News (BY OUR SPECIAL REPORTER)

IN the House of Lords on April 12th the second reading of the Electricity (Supply) Bill was agreed to. Lord Plymouth explained that the measure dealt with matters concerning the operation of the national grid system by the Central Electricity Board. The grid was now practically complete, and it was in full commercial operation in several of the original areas set up under the scheme. Experience had brought to light certain doubts and difficulties arising in connection with the provisions of the Act of 1926, and the Government felt that these should be resolved or removed to ensure the efficient working of the grid system.

There were certain "non-selected" stations which could produce electricity at a total cost which was lower than the cost of taking a supply from the Board at the general tariff rates. At present there was no particular inducement to such undertakings to become connected with the national grid system, but under the arrangements contemplated in Clause 1 these stations could very usefully be operated in conjunction with the grid system for the remainder of their economic lives, with advantage both to the Board and themselves. The Central Electricity Board had hitherto dealt with these stations by making special arrangements with the undertakers owning them for their control and for the interchange of supplies between the grid and these undertakers. Lately, however, doubts had been raised whether such arrangements could be made under the Act of 1926, and the clause could resolve that matter and validate all such arrangements hitherto made.

Clause 2 enabled the Board in cases in which it was satisfied that special circumstances existed, to quote special prices for electricity supplies directly from the grid system to authorised undertakers. It also enabled these authorised undertakers themselves to quote special prices to particular customers, such as large industrial undertakings in their areas of supply whose demands for electricity were of an exceptional nature. It was in the general interests of the grid system and of industrial development generally that the Board should have power to quote special prices to undertakers to enable the latter to meet the electrical demand of large industrial developments which might otherwise be beyond the undertakers own resources.

Clause 3 dealt with the terms on which supplies of electricity taken directly or indirectly from the grid system by certain authorised undertakers were to be passed on in bulk to other authorised undertakers. A number of the authorised undertakers possessed extensive networks of interconnected transmission lines used not only for bulk supply but also for industrial power supplies, and possibly for other supplies as well. Difficulties had arisen in attempting to apply Section 12 of the Act of 1926 as to the extent to which such transmission systems should be used for the purposes of particular supplies. It was proposed to apply it by giving powers to the Electricity Commissioners, if they were satisfied that it was in the general interest, to direct that the whole or a specified portion of the transmission system of any particular undertaker should be taken into account and the cost and charges applicable "posted" and properly apportioned in arriving at the transmission charges to be made by that undertaking in respect of individual bulk charges passed on to the system.

Clause 4 gave effect to the recommendation of the Weir Committee on Main-Line Railway Electrification. The clause would enable the Central Board to give supplies for haulage or traction purposes to railway companies directly from one or more points of the grid system.

In the debate which followed, the Opposition welcomed the Bill, but Lord Elibank strongly criticised it, describing it as "the thin edge of the wedge of nationalisation." It should be drastically amended in committee. The Central Board would in time supply the railway companies direct at charges even lower than those now imposed, with the result that private and industrial consumers would have further charges placed on them. The Bill was absolutely contrary to the whole policy of previous electricity legislation under which the right of undertakers to supply to the railways had been definitely preserved.

Lord Plymouth, in reply, denied that the Bill was the thin end of the wedge of nationalisation. There was no compulsion at all on authorised undertakers other than "selected" undertakers to come to an arrangement with the Central Board.

The Bill was read a second time.

Prices in Sutton and Wallington

In the House of Commons on April 11th, Sir R. Meller asked the Minister of Transport whether he was aware that, as a result of the electricity supply in the Sutton and Wallington districts, previously supplied by the South Metropolitan Electric Light Co., being taken over by the London and Home Counties Joint Electricity Authority, the price charged to consumers had been raised by from 20 to 34 per cent. according to circumstances; and what steps he proposed to take in the matter.

Mr. Stanley said his information was that the new tariffs introduced by the Authority had led to a substantial saving to consumers within the area previously supplied by the company. If, however, his hon. friend would supply him with particulars of any cases in which the charge to individual consumers had been compulsorily raised to the extent he mentioned, he would look further into the matter.

Viscount Falmouth's Bill

Standing Committee "C" of the House of Commons last week concluded its examination of the Electricity (Supply) Bill introduced by Viscount Falmouth with the backing of a number of members interested in electricity supply.

The Committee deleted Clause 24, which dealt with the protection of members and officers of local authorities from personal liability.

The following new clause (change of voltage or current) was moved by Mr. G. Peto and agreed to: "If undertakers change the voltage or the current supplied they shall, without charge to the consumer and to his reasonable satisfaction, alter, adjust, or replace any electric apparatus or fitting or radio instrument which may be adversely affected by the change on any of their consumers' premises."

Two more new clauses: "Provisions as to glebe land" and "amendment of definition of 'private purposes' in the Electric Lighting Act, 1882," were also agreed to.

The I.M.E.A. Convention

AS we have already reported, the annual convention of the Incorporated Municipal Electrical Association is to be held at Liverpool under the presidency of Mr. P. J. Robinson, city electrical engineer.

The president's reception will be held at the Adelphi Hotel in the evening of Monday, May 28th. On Tuesday, May 29th, a civic welcome will precede the presidential address, followed by the official opening of the electrical exhibition at St. George's Hall by the Lord Mayor (Coun. G. A. Strong, J.P.). In the afternoon a paper on "Developing the Power Load," by Mr. H. C. Lamb, city electrical engineer of Manchester, and Mr. W. E. Swale, will be read and discussed, and in the evening there will be a reception by the Lord Mayor and Lady Mayoress at the Town Hall.

On Wednesday, May 30th, a paper on "Modern Practice in the Layout of A.C. Distribution Systems," by Mr. L. Romero, city electrical engineer of Salford, is to be read. After the luncheon of the Electrical Association for Women there will be an afternoon visit. The Duke of York and the Earl of Derby will attend the evening reception and annual dinner at the Adelphi Hotel.

On Thursday, May 31st, a paper on "Electricity Supply to the Small Householder" will be read by Mr. J. W. J. Townley, borough electrical engineer of West Ham. There will be an afternoon visit and in the evening the Lord Mayor and members of the City Corporation will entertain the delegates to a dance on board the White Star liner *Georgic*.

On Friday, June 1st, the annual general business meeting will be held in the morning and a circular tour of North Wales will commence in the afternoon.

Arrangements are being made for delegates to visit the new Mersey Tunnel and all papers are to be read in St. George's Hall, where the exhibition will remain open until Saturday, June 2nd. We reproduce below a list of the concerns participating in the exhibition from whom a very representative and comprehensive display can be anticipated.

Exhibitors at the I.M.E.A. Convention

Aidas Electric, Ltd.
Alexandra & Fowler, Ltd.
Automatic Electric Co., Ltd.
Bastian & Allen, Ltd.
Belling & Co.
Berry's Electric, Ltd.
Bray, Geo., & Co., Ltd.
British Electrical Development Association
British National Electrics, Ltd.
British Sangamo Co., Ltd.
British Thomson-oHuston Co., Ltd.
Brookhirst Switchgear Co., Ltd.
Bulpitt & Sons, Ltd.
Burnley Components, Ltd.
Carron Company
Corfield-Sigg, Ltd.
Drake & Gorham (Wholesale), Ltd.
Edison Swan Electric Co., Ltd.
Electrical Association for Women
Electrical Contractors' Association
Electric Domestic Appliance Co.
Electric Fires, Ltd.
Electric Lamp Manufacturers' Association
Electrolux, Ltd.
English Electric Co., Ltd.
Evershed & Vignoles, Ltd.
Falk, Stadelmann & Co., Ltd.
Falkirk Iron Co., Ltd.
Ferguson, Pailin, Ltd.
Ferranti, Ltd.
General Electric Co., Ltd.
G.P.O. (Liverpool)
Green, G., & Co.
Greene Phillips & Co., Ltd.
Hague & McKenzie, Ltd.
Hawkins, L. G., & Co., Ltd.
Henley's, W. T., Telegraph Works Co., Ltd.
Horstmann Gear Co., Ltd.
Hotpoint Electric Appliance Co., Ltd.
Jackson Electric Stove Co., Ltd.
Johnson & Phillips, Ltd.
Leda Electric, Ltd.
Low, Arch., & Sons, Ltd.
Liverpool Corporation Measurement, Ltd.
M.K. Electric, Ltd.
Moffats, Ltd.
Radiovisor Parent, Ltd.
Reyrolle, A., & Co., Ltd.
Revo Electric Co., Ltd.
Rushworth & Dreaper, Ltd.
Santon, Ltd.
Siemens Electric Lamps & Supplies, Ltd.
Simplex Electric Co., Ltd.
Stokes Appliances, Ltd.
Unity Heating, Ltd.
Venner Time Switches, Ltd.
Vidro Neon, Ltd.
Waygood-Otis, Ltd.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

The Southend Electrical Exhibition

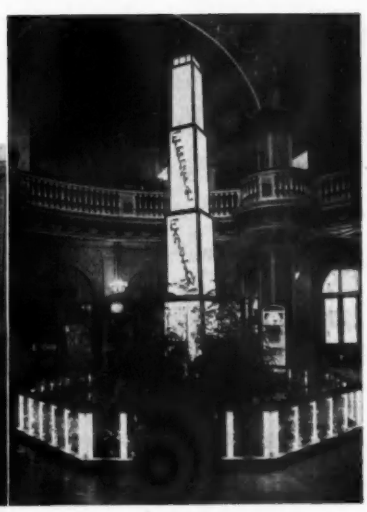
By passing his hand through an invisible ray on April 11th the Mayor of Southend, Councillor H. E. Frith, caused the words "Exhibition Open" to appear on a screen behind him and thereby inaugurated the third electrical exhibition held by the Electricity Department at the Kursaal.

The Mayor spoke of the extraordinary progress of the electricity undertaking, and said that the number of consumers had risen from 9,300 in 1921 to 29,000 to-day. Sixty per cent. of the consumers were now taking a.c. supplies and the capital expenditure on the undertaking now amounted to £1,200,000, of which £140,000 had been spent during the year. A total of 550 men was now employed as compared with 320 a year ago. Southend was one of the most enterprising towns in the country with regard to electricity supply, and last year the undertaking contributed £7,500 towards the rates.

Sir William Ray, chairman of the British Electrical Development Association, congratulating the chairman of the Electricity Committee and the electrical engineer on their endeavours to make Southend electrically minded, said that there were many urban districts in England with large manufacturing interests, such as Southend did not possess, which would be envious of the tariffs provided for Southend consumers. In these difficult times it was a comfort to note the progress made in the supply industry; in the last ten years the capacity of generating stations had increased from three million kilowatts to over 7½ million kilowatts.

Other speakers included Alderman S. F. Johnson, acting chairman of the Electricity Committee, and Councillor S. C. Taylor, Mayor of Chelmsford.

In addition to the usual features, the exhibition provided special attractions in the form of an all-electric bungalow, invisible-ray demonstrations and a visit by Mr. George Robot, "the world's super-electro-mechanical man." There were also demonstrations of cooking, heating, refrigeration, water heating, &c., and to each winner of a poster guessing competition a prize of a waffle iron was presented.



Pictures taken at the electrical exhibition held at the Kursaal, Southend-on-Sea. Left: Entrance to the All-electric Bungalow. Below: The Mayor performing the opening ceremony. Right: A 20-ft. illuminated "pylon" in the entrance hall

Partridge, Wilson Battery Vehicles

Having specialised in rectifying and battery-charging equipments for many years, Messrs. Partridge, Wilson & Co., Davenset Works, are now manufacturing electric vehicles. The first model is a battery-driven van of 5-6 cwt. carrying capacity, and a variety of bodies is to be made for trade delivery service. The 129-AL battery of 20 "Exide-Ironclad" type I.M.V.4 cells hangs in four crates centrally between the four wheels of the pressed-steel chassis. The rear axle is driven through differential and spiral bevel gears coupled flexibly through a propeller shaft to the motor just behind the front axle. The controller is unusual, being concentric with the steering column, and operates in conjunction with a foot switch that closes an oil-immersed contactor. The series-parallel battery connections and motor field arrangement are such as to render the use of external resistance unnecessary.

"Diamond H" Switches

As reported in our "New Companies" section this week, the business of the Hart Manufacturing Co. has now been transferred to a private limited company, and in future will be carried on under the name of "Diamond H" Switches, Ltd. The registered offices of this company will continue to be at Gunnersbury Avenue, Chiswick, and the business will generally be carried on as it was under the old company. Mr. C. A. Turner will become the first managing director of the new company.

The Portuguese Radio Market

A confidential report on the market for radio apparatus in Portugal has just been issued by the Department of Overseas Trade and British firms wishing to obtain copies should apply to the offices of the Department, 35, Old Queen Street, S.W.1, quoting reference No. A.Y. 12233.

A New Marketing Development

A marketing scheme has just been arranged by the Telephone Manufacturing Co., Ltd., which is forming a new company to be known as T.M.C.-Harwell Sales, Ltd., to take over Harwell, Ltd., of the Sessions House, Clerkenwell Green, E.C.1, and the agencies held by that concern, including those for the P.H. British Electrical Works, Ltd., West Norwood, S.E.27, and Agro Electrical Co., Ltd., Aylesbury. The new company will also act as trade distributors for all "T.M.C." products except public telephone equipment—marine telephone, and electrical apparatus—and the "New System" telephones handled by the subsidiary companies of Telephone Rentals, Ltd. The Telephone Manufacturing Co., Ltd., will specialise in electrical accessories and similar products on a large scale. Mr. H. M. Harris will be managing director of T.M.C.-Harwell Sales, Ltd., and Mr. C. J. Abercrombie will be sales director, both these gentlemen having held similar positions with Harwell, Ltd. Mr. W. A. Jackson, M.I.Mech.E., general sales manager of the Telephone Manufacturing Co., Ltd., will be on the board, and the chairman will also be appointed by the Telephone Manufacturing Co., Ltd. Premises in Central London are to be taken for the new sales company.

Registered Electrical Contractors

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Mikijohns, Ltd., Ashbourne, Derbyshire.
Hill, S., & Co., Ltd., Grassendale, Liverpool.
Pickup, W., & Son, Blackburn.
Martin, A., Llanharan.
Hilton, L., Heaton Park, Manchester.
Fazackerley & Co., Droylsden, Manchester.
Hope, A. A., Hightown, Manchester.
Ash, J., Levenshulme, Manchester.
Walton, J. H., Great Harwood, near Blackburn.
Jones, E., & Co., Liverpool.
Boothroyd Electrical Co., Ltd., Liverpool.
Thomasson & Co. (Shrewsbury), Ltd., Shrewsbury.
Brown, H., Grimsby.
Cotton, J. K., & Co., Rochdale.

At the same meeting one application was withdrawn and five were declined.

New Electricity Showrooms

It has been decided by the Cheadle Electricity Committee to spend £3,700 on an electricity showroom to be located in Station Road, Cheadle Hulme.

New showrooms for the Electricity and Gas Departments of the Warrington Corporation were formally inaugurated on April 13th. A description of the new showrooms will appear in our next issue.

Electrical Contracting at Ashton-under-Lyne

A recommendation was submitted to the Ashton-under-Lyne Town Council last week by the Electricity Committee that, as from July 1st next, it should be a condition for wiring contractors under the Corporation assisted-wiring scheme to

be on the National Register of Electrical Installation Contractors. There was considerable discussion on this as it had been complained that the Electricity Committee was constituting itself judge and jury in deciding which was the right firm to execute the wiring contracts. Objection was taken to the creation of a local monopoly. It was stated that there were only four firms in the town that were on the Register, and about twenty-five firms had done work for the Corporation under the assisted-wiring scheme. The chairman of the Electricity Committee agreed to take the matter back for further consideration.

N.E.S. Year Book

An interesting year book has just been received from the North-Eastern Electric Supply Co., Ltd. Besides giving an account of the proceedings at the company's recent general meeting, it contains illustrated descriptions of the development during the year, power plant construction, rural and agricultural supplies, travelling showrooms, and other items of general interest.

A portion of the exhibition arranged by the Electricity Distribution of North Wales and District, Ltd., at Whitchurch

German Electrical Exports

In February the value of exports of electrical machinery and goods declined by Rm. 3,000,000 as compared with the previous month.

Social Events

The Chief Technical Assistants' Association held its nineteenth annual dinner at the Holborn Restaurant on April 7th, when forty-three members and friends spent a very enjoyable evening. Mr. Purse, chief engineer of the London and Home Counties Joint Electricity Authority, proposed the toast of the Association. In his reply, the chairman, Mr. B. C. Ward (deputy borough electrical engineer, Bermondsey) said that thanks to the recent influx of new members, the Association now represented nearly all the municipal undertakings in London. Mr. J. H. Parker (electrical engineer to the Tramways Section of the London Passenger Transport Board) proposed the toast of "the visitors" which was suitably responded to by Mr. F. N. Rendell Baker (borough electrical engineer, Croydon).

In the Wallasey and Birkenhead Electrical Trades Golfing Society's second competition the best card returned was that by Mr. B. T. Hawkins, the borough electrical engineer of Wallasey. Mr. Hawkins won the President's cup, presented by Mr. A. Hawkins, which he received from the hands of Mr. F. E. Spencer, the borough electrical engineer of Birkenhead. In the class "B" competition the prize-winner was Mr. W. Edwards.

The fifth annual smoking concert of the Association of ex-Siemens Men was held on Friday last at Gatti's Restaurant, London. Mr. R. W. Whitley presided over a company numbering about 100 who had come from all parts of the country. The event of the evening was the presentation to Mr. J. Snow Huddleston of a silver rose bowl, vases, and a pint tankard suitably inscribed, as a mark of esteem and as a token of thanks for his services as honorary secretary. The chairman read letters and telegrams from members unable to attend, and referred to the efforts of all ex-Siemens Men to assist any of their old colleagues who, in these difficult times, were not fortunate enough to be in any employment. During the evening an enjoyable variety programme was contributed. A membership book which was presented with the programme shows that the Association is now about 250 strong. The chairman submitted the toast to absent ex-Siemens Men, and remarked that seven members had "passed on" since the Association was formed.

Great Britain's Improved Outlook

Speaking at the annual general meeting of the Federation of British Industries last week, Sir George Macdonogh, the retiring president, said that 1933 could be looked upon as a year of steady but gradual expansion in nearly all branches of economic activity. There was solid ground for satisfaction and hope for the future, but no reason for complacency. During 1933 the accumulated stocks of foreign products became exhausted, and the imposition of the British tariff became really effective. Such progress was heartening, but there was a real danger that the level of our domestic production might be seriously impaired by foreign competition in the form of depreciated currencies, subsidies, or through increasing competition from countries with a lower standard of living. During the past eighteen months a spirit of confidence and initiative had returned to this country, and Great Britain had regained her position as the chief exporting country of the world. We had held our own and done better than our competitors, but we were not yet selling that volume of goods which would enable us to reduce the ranks of the unemployed.

Electrical Exhibitions in North Wales

The Electricity Distribution of North Wales and District, Ltd., is now completing a series of special electricity weeks in its area, more particularly in connection with new rural developments which have recently been carried out. As will be seen from the accompanying illustration, the company has had a number of portable stands specially designed so that transport and erection has been a simple matter. Excellent business has resulted, and a very healthy interest has been stimulated in the company's service. Publicity consisted of the distribution of handbills at schools and from door to door, together with poster display and newspaper advertising. A large illuminated sign bearing the word "Electricity" in five-foot letters was made up in sections and erected on the front of each hall and supplemented by a moving figure of a butterfly in colours. The combined effect was remarkable, and, as a result, many inquiries for outside lighting publicity signs, &c., have been received. The series finishes at Barmouth on April 24th.

The Woking Showrooms

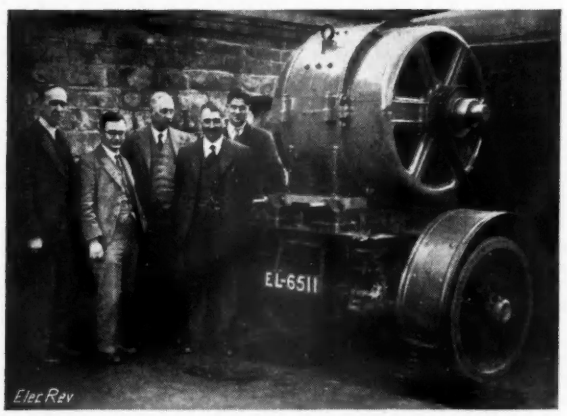
With reference to the extension to the showrooms of the Woking Electric Supply Co., Ltd., described in our last issue, the whole of the work was carried out under the direct supervision of Mr. F. Woods, the resident engineer, and Mr. G. Nicholson, the secretary of the company.

The New H.M.V. Refrigerator

No pains are being spared by H.M.V. Household Appliances, Ltd., to give their first product, the H.M.V. refrigerator, a good send-off in the electrical market, and a quantity of attractive publicity material has been prepared. A booklet with a striking blue and black cover is being sent to members of the trade who have expressed interest in the company's products, while supplies of catalogues and leaflets illustrated in colour are available for overprinting.

A "Showman's" Dynamo

Owing to the increased taxation the use of a steam traction engine with electric dynamo mounted in front of the boiler has become uneconomical for travelling showmen, and Mr. J. Studt, Junr., has adopted the method shown in the accompanying illustration. Instead of a steam tractor, Mr. Studt is using a Scammel lorry with a dynamo mounted on the platform and driven by two chains. This dynamo, which gives an output of 33 kW at 200 r.p.m., weighs 3¼ tons, and being mounted over the rear wheels, furnishes the lorry with sufficient road gripping force to enable the usual train of caravans to be drawn along the roads. The dynamo was specially designed and built by Mawdsleys, Ltd., of Dursley.



A "showman's" dynamo

False Economy

A new lamp attachment of foreign service has been called to our notice by Philips Lamps, Ltd. It consists of two holders, one for an ordinary bulb, and the other for a dim night lamp;

the small bulb is supplied with the attachment. With a bakelite finish and steel chain the fitting gives every appearance of being a serviceable article, but on being subjected by Philips to their photometer test, it was shown that the lamp in question, though marked 5 watts, actually consumes 15 watts.

Sales Promotion at Poplar

The Poplar Electricity Department has put into service a Morris motor van driven by a chauffeur-demonstrator. This is finished in blue enamel and has on each side a glass-panelled window in which there are displayed on one side various types of electric fires and in the other toasters, irons, lampshades and a kettle. On the rear doors of the van are

Two views of the Poplar Electricity Department's new demonstration van

the words "Your Obedient Servant—Electricity." The van is touring a selected area each week, canvassing from house to house, and also following up inquiries from people who desire to see some electrical appliances, and in this way prospective buyers are able to have the apparatus demonstrated in their own homes. We were informed that although the scheme has only been in operation a week the results, apart from the advertising value, have been more than satisfactory.

A New E.M.I. Company

An important new organisation—E.M.I. Service, Ltd.—has been formed to take over all service activities of the Gramophone Co., Ltd., the Columbia Graphophone Co., Ltd., and the Marconiphone Co., Ltd., as from April 9th, 1934. The objects of the new company are described in an attractive brochure, which is being issued to dealers.

Electricity in Agriculture

Sir William Ray is to give an address on "The Application of Electricity to Agriculture," at a meeting of the Farmers' Club to be held on April 30th at the Royal United Service Institution, Whitehall, S.W.

Premier Electric Heaters Works Extensions

Premier Electric Heaters, Ltd., of Birmingham, has acquired additional land, with canal wharfage, adjoining its present site, and is shortly commencing an extension which will increase its present floor space by 50 per cent.

Recent Contracts

The L.N.E. Railway Co. has placed an order with Messrs. H. Lees & Co., Ltd., Glasgow, for a 250-ton electrically operated coaling plant for its Norwich depôt.

The D.P. Battery Co., Ltd., has just secured a contract from the Birmingham Salvage Department for the supply of a further twenty-six "Kathanode" batteries for electric cleansing vehicles. A "Kathanode" locomotive-type battery is also to be fitted by the English Electric Co., Ltd., on a standard-gauge battery-operated shunting locomotive which it is building for the Dundee Electricity Department.

Prices of Materials

Messrs. F. Smith & Co. report April 18th: No change in the prices of electrolytic copper bars, wire rods and h.c. wire, and silicium bronze wire.

Messrs. Edward Till & Co. report April 18th: No change in the price of india-rubber, Para fine.

Messrs. James & Shakespeare report April 18th: No change in the prices of copper bars (best selected), sheet and rod, and English pig lead. Electrolytic copper sheets, £36 to £36 10s., 10s. decrease.

Trade Announcements

Messrs. W. Andrew Bryce & Co. have recently concluded the purchase of the "Peak" condenser and terminal block business of Messrs. Wilburn & Co. The company is now in a position to supply complete requirements for mains gear and television.

Messrs. T. Beadle & Co., Ltd., wholesale electrical factors, have opened a new branch at 17, Queen Street, Manchester.

Mr. W. Freshwater has acquired the business of the Rugby Electrical Engineering Co., of 46b, Regent Street, Rugby.

Alliance Wholesale, Ltd., 62, Great Russell Street, W.C., informs us that it holds stocks of slotted steel at its London address.

Static Electric, Ltd., 52, Old Street, Ashton-under-Lyne, is shortly opening a small works in Manchester for the supply and repair of electrical machinery, and asks for catalogues in duplicate, particularly relating to motors and starters, associated switchgear, and raw materials for repairs, to be sent to its Ashton branch.

The Isola Manufacturing Co., having outgrown their old workshop, have added several buildings to their premises at Shepley Street Works, London Road, Manchester, and the alterations are now completed, giving increased output and larger stock accommodation.

Owing to increase in business, Brook Motors, Ltd., are moving on April 30th to First Avenue House, High Holborn, London, W.C.1 (telephone number unchanged).

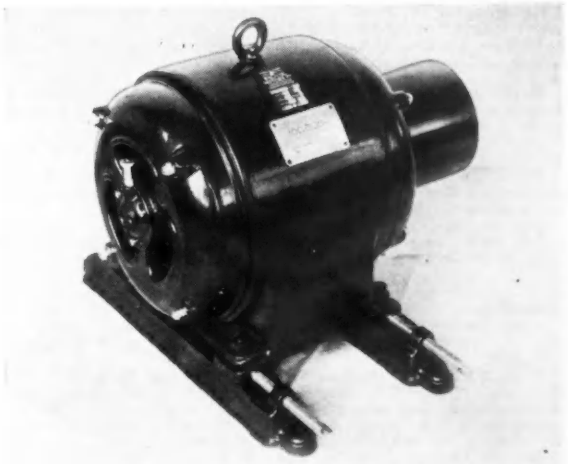
Western Lamps, Ltd., has removed to 63, Queen Victoria Street, E.C. (Telephone: City 2517.)

The Shenley Mental Hospital

Referring to the article upon this institution in our issue of April 6th, Messrs. Worthington-Simpson, Ltd., who supplied the two borehole pumps mentioned, inform us that these pumps are driven by motors made by Messrs. Laurence, Scott & Electromotors, Ltd., not by E.C.C. machines as stated.

The First Hundred Thousand

We reproduce below a photograph of the 100,000th electric motor to be actually made and sold by Brook Motors, Ltd., of Huddersfield. This achievement is all the more remarkable



The 100,000th electric motor to be sold by Brook Motors

as the motors are all induction motors and as the company does not manufacture fractional-h.p. motors; in fact, that average h.p. of the 100,000 motors is a little over 7½. The actual motor shown was sold to Messrs. Christy Bros., Ltd., of Chelmsford.

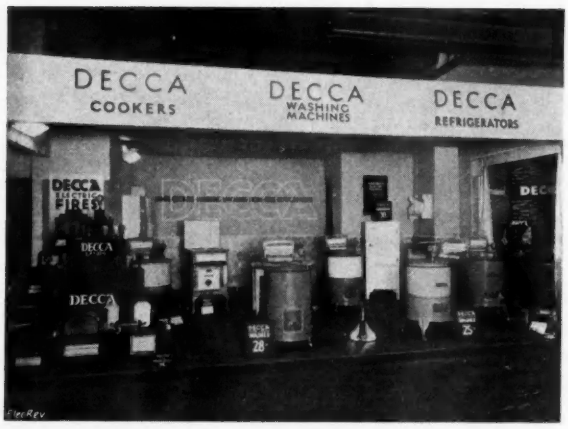
A Visit to Metrovick Works

Members of the Nelson Textile Society and the Rochdale Textile Society paid a visit to the Trafford Park Works of the

Metropolitan-Vickers Electrical Co., Ltd., last Saturday afternoon. The parties consisted of about sixty members from each society, and a short tour was made round the works. A demonstration in the company's high voltage laboratory was also included, and at the end of the visit tea was provided in one of the staff canteens. On behalf of the management, Mr. F. B. Holt welcomed the visitors to Trafford Park, and the vice-president of each society responded.

A Decca Display

The accompanying illustration shows the section of the stand of the Decca Record Co., Ltd., at the Ideal Home Exhibition, on which an extensive range of electrical household appliances



A display by the Decca Record Co., Ltd., at the Ideal Home Exhibition

is displayed. These include electric cookers, washers, refrigerators, and smaller appliances, such as irons, toasters, and mincer-mixers.

For Sale

Coventry Electricity Department has for sale one 3,000-kW turbo-alternator and four water tube boilers. (See our classified advertisements.)

New Catalogues and Lists

Revo Electric Co., Ltd., Tipton, Staffs.—Leaflets illustrating and describing electric panel heaters and circulator heaters.

Leach Electrical & Engineering Co., Ltd., 169, Upper Thames Street, London, E.C.4.—List LS 2/34, dealing with d.c. and a.c. syrens.

W. Andrew Bryce & Co., Woodfield Works, Bury, Lancs.—Illustrated leaflets giving particulars of transformers, condensers and other radio equipment.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 932, describing a new type of a.c. and d.c. fuses.

Sloan Electrical Co., Ltd., 8, 10 & 12, Golden Lane, E.C.1.—A leaflet dealing with vacuum cleaners.

Electric Depôt, Ltd., Pritchett Street, Aston, Birmingham.—A pamphlet giving details of adjustable electric lighting fittings.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Ironclad switchgear booklet No. X.6764.

Aerograph Co., Ltd., Lower Sydenham, London, S.E.26.—New paint-spraying equipment just developed for producing the new flock or suede-like finish.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—An illustrated pamphlet, giving particulars of the "Philora" sodium lamps for street lighting.

Royce & Browne, 6, Grafton Mews, London, W.1.—Particulars of a new electric furnace with a freely detachable heating unit.

Cochranes (Middlesbro') Foundry, Ltd., Middlesbrough.—A stock list of spun iron pipes.

Crompton Parkinson, Ltd., Guiseley, Yorks.—A leaflet illustrating the Parkinson protected type squirrel-cage motor.

Ferguson Pailin, Ltd., Higher Openshaw, Manchester.—Catalogue sections, Nos. 71A4 and 71A5, dealing respectively with types "SR" and "ST" 33-kV oil-immersed isolating switches.

Bruce Peebles & Co., Ltd., Edinburgh.—Price list No. 27, covering a range of industrial type a.c. squirrel-cage and slip-ring motors up to 150 b.h.p., together with accessories and control gear.

Leda Electric, Ltd., Oldham Road, Miles Platting, Manchester.—A number of illustrated leaflets dealing with service cabinets.

Thos. Firth & John Brown, Ltd., Atlas and Norfolk Works, Sheffield.—"The Staybrite Book" (pp. 464), illustrating the numerous applications of "Staybrite" steel. Many of the manufacturers of goods made from this steel have co-operated by illustrating and describing their products.

British Insulated Cables, Ltd., Prescot, Lancs.—Publication No. M.22, relating to "Rockbestos" switchgear wires and cables.

Bankruptcy Proceedings

A. G. Franklyn, "Pineridge," Tinshill Road, Cookridge, Leeds, formerly at 3, Boar Lane, Leeds, wireless retailer.—The public examination was held on April 10th, at the County Court House, Albion Place, Leeds, when the statement of affairs showed a deficiency of £207. Debtor gave the "delay in opening local broadcasting stations" as one of the reasons of his failure. He admitted that in 1931 a deed of assignment had been executed, and a dividend of 6d. in the £ was paid on liabilities of £1,312. The examination was adjourned for formal closing.

H. G. Lawson, trading as "E. Cooper," radio and electrical dealer, 1002, Stratford Road, Hall Green, Birmingham.—The public examination was held at the Court House, Birmingham, on April 11th. There were unsecured liabilities of £564, and a deficiency of £476. The failure was attributed to want of capital, loss on trade due to keen competition, reduction in prices by manufacturers, and depreciation of effects. The examination was adjourned for closing.

D. Tweedle, 42, Market Street, Milnsbridge, Huddersfield, radio and electrical engineer.—The public examination of this debtor was held on April 11th at the County Court, Huddersfield.—There were liabilities of £125, and assets of £43. The failure was attributed to insufficient turnover and bad trade. The examination was closed.

G. S. Elliott, 70, Rupert Street, Norwich, electrical engineer.—The public examination of this debtor was closed at the Shirehall, Norwich, on April 10th. According to the statement of affairs the gross liabilities were £219, of which £190 was expected to rank. Debtor commenced business in 1929, borrowing money from relatives. Debtor admitted that he had been in difficulties for some eighteen months, prior to taking a shop in Lowestoft, which he ran for about three weeks. The turnover at Norwich during the last two years had been about £3 weekly, and debtor attributed his present position to insufficient trade.

A. L. Pearce, 12, Fore Street, Newquay, Cornwall, electrical supplies dealer.—The public examination herein was held at the Town Hall, Truro, on April 10th. Debtor said that early in 1933 he commenced trading as an electrical dealer. He attributed his failure to insufficient turnover to meet trade and personal expenses.

H. J. Couzens, 165, Young Street, Sheffield, electrical contractor.—Unsecured liabilities of £2,506, and assets of £834 were disclosed at the public examination of this debtor held recently at the County Court Hall, Sheffield. Of the liabilities, £1,689 was in respect of money which debtor had borrowed. He commenced business on his own account at the Moor, Sheffield, in March, 1922, and for a time the business was successful. In December, 1928, he gave up the Moor premises, and rented others in Young Street. In 1927 a creditor sued, and debtor secured loans amounting to £400 from a moneylender at 30 per cent. interest. Since then debtor had borrowed other monies. The failure was attributed to heavy overhead expenses, competition, general trade depression, and interest on loans. The examination was concluded.

P. Kalis (Ludgate Circus Radio), wireless dealer, 4, Ludgate House, Ludgate Circus, E.C.—Application for discharge to be heard on May 3rd at Bankruptcy Buildings, Carey Street, W.C.

R. F. Palmer, electrical engineer, 19, Church Street, Burnley.—Last day for receiving proofs for dividend April 24th. Trustee, Mr. J. W. Carter, District Bank Chambers, Blackburn, Official Receiver.

E. H. Goldie (Dudley Radio and Electrical Service), Dunkerque, The Parade, Dudley.—Receiving order made April 10th on debtor's own petition.

R. Phœnix (Monarch Radio Service), radio engineer, 28, Tramway Street, Leeds.—Receiving order made April 11th on debtor's own petition.

B. Hetherington, wireless dealer, Westgate, Elland.—Application for discharge to be heard May 10th at the County Court, Halifax.

W. H. J. Willcox, radio dealer, 22, North Street, Downend, near Bristol.—Last day for receiving proofs for dividend May 1st. Trustee, Mr. H. Wheeler, 26, Baldwin Street, Bristol, Official Receiver.

H. Parker, wireless dealer, 10, Stratford Street, Nuneaton.—Last day for receiving proofs for dividend April 30th. Trustee, Mr. C. J. Band, 9-11, High Street, Coventry, Official Receiver.

T. E. Harvey, radio and electrical engineer, 64, Leagrave Road, Luton.—Last day for receiving proofs for dividend April 27th. Trustee, Mr. T. Bengough, 6, The Parade, Northampton, Official Receiver.

R. Robinson, electrical engineer, The Arcade, Waterfoot.—Last day for receiving proofs for dividend April 28th. Trustee, Mr. R. K. Clark, Byrom Street, Manchester, Official Receiver.

S. Purcell, electrical contractor, The Arcade, Goole.—Supplemental dividend of 1s. 7d. in the £, payable April 13th, at 13, Burton Street, Wakefield.

Receiving Order Rescinded

W. W. Wright, formerly trading as Wright & Craven at 192, Hunslet Road, Leeds.—Receiving order dated January 3rd, 1934, rescinded on February 19th on appeal to the Divisional Court.

Company Liquidations

Patricks Radio, Ltd.—Meeting, May 14th at 196, Deansgate, Manchester, to receive an account of the winding-up by the liquidator, Mr. R. S. Estcourt.

Mercurial Cut-Outs, Ltd.—Meeting May 7th at 46, Basinghall Street, E.C., to receive an account of the winding-up by the liquidator, Mr. M. Lancaster.

Ingham Electrical Co., Ltd.—Meetings May 11th at 71, Albion Street, Leeds, to receive an account of the winding-up by the liquidator, Mr. T. A. Stoker.

Dissolution of Partnership

National Radio Supplies, radio dealers, Midland Road, Derby.—Messrs. I. A. Young and B. G. Wood have dissolved partnership. Mr. Young will attend to debts and carry on the business.

Private Arrangement

G. I. D. Bowman, 16, City Road, Bedminster, Bristol.—A meeting of creditors was held on April 12th, at the offices of Messrs. E. T. Collins & Son, 28, Baldwin Street, Bristol, when the statement of affairs showed liabilities of £326 and net assets of £302, leaving a deficiency of £24. It was stated that the debtor commenced the wireless business in 1929. He carried it on at various addresses and eventually closed it, estimating the loss sustained at £300 to £400. An offer was made of a composition of 10s. in the £, payable by weekly instalments, but not guaranteed. It was resolved that a deed of assignment should be executed to Mr. A. Collins as trustee, with a committee, and it was suggested that the debtor should pay weekly instalments to the trustee towards the composition of 10s. in the £.

Electricity Supply

Lighting, Domestic, Power

Australia.—Municipal Undertakings in N.S.W.—In an address at Sydney at the annual conference of the Electricity Supply Engineers' Association, the New South Wales Minister for Local Government (Mr. Spooner) said that in 1909 there were only seven municipally controlled electricity undertakings in the State, in 1919 there were 18, and in 1932 there were 123. In 1909 the number of kWh supplied by councils was 12 millions. In 1932 this had risen to 467 millions, and in the same year the amount invested in these undertakings was £250,000,000. This did not include privately controlled undertakings. He expressed the view that the proposed Electricity Commission should not be allowed to interfere with council control, and that councils should be allowed to retain their powers of management. Mr. H. K. Crisp, of Bowral, was elected president of the association.

Progress of Nymboida Scheme.—Mr. N. V. S. Wilton, chief engineer and manager of the Nymboida hydro-electric scheme, in his annual report to the Clarence River County Council, states that during the past year the undertaking has experienced outstanding progress and development. The electricity sold, exclusive of power station consumption, amounted to 6,036,705 kWh, compared with 5,000,341 in 1932. Revenue from sales of electricity was £51,780, an increase of £3,761, the total revenue being £53,560. Additional consumers connected numbered 413, making a total of 3,609. Working expenses were £26,173; interest and redemption of principal brought the total expenditure to £48,926, giving a surplus of £4,634. It is estimated that the revenue for 1934 will be £62,400, and expenditure £57,567, and that £3,000 will be required for extensions to the system and £101,929 for construction work.

Barrow-in-Furness.—Overhead Lines.—The Corporation Electricity Committee has obtained sanction to erect overhead lines to supply Broughton East, Upper Allithwaite, Yarlside, Ormsgill, Dalton-in-Furness, Urswick, Pennington, Blawith, Broughton-in-Furness, Staveley, and Lower Allithwaite. The Corporation and the Windermere Electricity Co., Ltd., have agreed to modification of their respective areas of supply. A loan of £20,000 for mains and services has been sanctioned.

An engineering inspector of the Electricity Commissioners is to inquire into the difference of opinion which has arisen over the bulk supply furnished by the Corporation to the Grange Urban District Council.

A fringe order is to be applied for in respect of supply to Broughton.

Blackburn.—Reduction of Charges.—The domestic tariff has been revised to 5 per cent. net rateable value. First 240 kWh per quarter, ¾d. per kWh, and a ½d. per kWh for all in excess; heating, cooking, baking, and domestic power will cost: First 960 kWh, 1d. per kWh; in excess ½d. per kWh, with a minimum charge of 5s.; the water-heating rate has been sanctioned at a flat rate of ½d. per kWh.

Bolton.—Rate Relief.—It was reported at a recent meeting of the Town Council that £10,000 was being transferred from the Electricity Department towards the relief of rates.

Bridport.—Loan.—The Town Council has applied for sanction to a loan of £4,805 for a 230-kW set at the power station.

Burnley.—Supply Application.—The Electricity Committee has recommended application to the Electricity Commissioners for an Order to supply electricity to Burnley rural townships.

Chanctonbury (Sussex).—Overhead-line Inquiry.—A Ministry of Transport inquiry was held on April 4th into the proposal of the Steyning Electricity Co. to erect overhead lines across Sullington Warren. The Rural District Council objected and, for the electricity company, it was said that underground mains would cost £1,144, whereas overhead lines would cost approximately £823.

Clacton-on-Sea.—Price Reduction.—The Urban District Council has reduced the charge for electricity for lighting by ½d. per kWh, and on the two-part tariff there is a reduction from 20 per cent. to 12½ per cent. A new feeder cable is to be laid, at an estimated cost of £450, for which sum a loan is being applied for, and the Council has adopted a scheme submitted by the electrical engineer, Mr. G. Broadhurst, for improving the lighting along the sea-front at an estimated cost, including current for three months, of £1,336.

Clydebank.—Mains Extensions.—An application from the Strathclyde Electricity Supply Co., Ltd., for sanction to supply electricity to the Munitions housing scheme, East Kilbowie, is being considered by a special committee of the Town Council. The company has received permission to lay cables in Drumry Road, near Kilbowie Road, Clydebank.

Colchester.—Overhead Lines.—The City Council has applied to the Minister of Transport for consent to erect overhead lines for a supply of electricity to the Peldon and Pete Hall district, the estimated cost being £807 for an e.h.p. line and transformer, and £808 for l.p. work. It is also proposed to lay mains in proposed new roads, and, subject to a satisfactory canvass, a supply is to be given to premises at Goldhanger.

Dartford.—Mains Extensions.—The Electricity Committee is to extend mains and erect a sub-station at a cost of £6,871.

Duns.—Overhead Line Opposition.—The Town Council received notice from the Scottish Southern Electric Supply Co., Ltd., as to a proposed low-voltage network in the town, and it was agreed to remit the matter to the Streets and Lighting Committee with a direction to oppose to the uttermost any attempt to put in overhead cables.

Ealing.—New Sub-station.—The Uxbridge & District Electric Supply Co., Ltd., is to erect a sub-station at Windmill Lane.

East Ham.—Loan.—The Corporation Electricity Committee is seeking sanction to borrow £5,000 for the provision and installation of electric cookers.

Eastry.—Rural Supplies.—The South-East Kent Electric Power Co., Ltd., has informed the Rural District Council that arrangements are being made to give a supply of electricity to Ash-next-Sandwich, and that other smaller villages will receive attention later on.

Eccles.—Cooker Hire Scheme.—At the Electricity Committee the engineer drew attention to the slow progress in the sale and hire-purchase of electric cookers, and recommended the Committee to resume the practice of letting out cookers on simple hire terms. The Committee decided that electric cookers, complete with a kettle and wiring circuit up to 30 ft., be let on simple hire at a rental of 7s. 6d. per quarter.

The Health Committee has decided to send a circular and questionnaire to all the tenants of the Westwood Park Estate, to ascertain the potential demand for the supply of electricity for purposes other than lighting, and recommends a contribution of 25 per cent. towards the cost of installation of power circuits by tenants.

Falkirk.—Area Extension.—The Town Council is promoting a Provisional Order for authority to extend its electricity area of supply, and further powers in relation to its electricity undertaking. The boundaries of the burgh were extended by an Order of 1929, but the Town Council's area of supply remained within the burgh as constituted at the time when the Falkirk Electric Lighting Order, 1901, was passed.

Glasgow.—Coal Plant Extensions.—The Corporation Electricity Committee, in order to facilitate the handling of coal at Dalmarnock generating station, has authorised an extension to the coal-handling plant for No. 3 boiler house. An offer by the makers of the original plant, Strachan & Henshaw, Ltd., Bristol, to install an additional coal skip hoist and wagon traverser for £2,250 has been accepted. Two additional economisers are to be fitted to boilers Nos. 13 and 14, and the Committee agreed that the offer of E. Green & Son, Ltd., amounting to £1,816, be accepted.

Mains.—The Electricity Committee has agreed that distributing mains be laid at a cost of £22,512.

Sub-station.—The Committee has authorised the manager to proceed with the erection of a sub-station in connection with the supply of electricity in the Queen's Park district.

Great Yarmouth.—Rate Relief.—The Electricity Committee has decided to contribute £4,000 from the electricity fund towards the relief of the rates for the year.

Loans.—The Electricity Committee has obtained sanction to borrow £5,300 for the provision of additional submarine cables across the river Yare, and £1,151 for laying underground mains in the Wrentham area.

Hailsham.—Supply Extension.—The Weald Electricity Supply Co., Ltd., has informed the Rural District Council of its intention to extend its supplies to the parishes of Ripe and Chelvington.

Hamilton.—Housing Scheme Overlapping.—The Corporation has adopted a recommendation by a joint meeting of the Gas and Electricity Committee, held to consider the overlapping of services in housing schemes, that, so far as existing schemes are concerned, no alteration be made in the present arrangement under which tenants are free to introduce electricity and to make whatever use of that medium they choose, and that in the case of all future schemes where electricity and gas are introduced, the former shall be used for the purpose only of lighting and such ancillary purposes for which gas cannot be used, gas to be used for heating and cooking.

Hastings.—Electricity Supply.—The Electricity Committee is to provide a supply to the Milward estate (£542), Westfield Place (£430), and Wickham Farm (£500).

Relaying Cable.—The Corporation is to relay the cable on part of the promenade, at a cost of £580.

Ilford.—Progress.—The steady progress made by the Borough Council's electricity undertaking was the subject of an address by Councillor John Tubb, vice-chairman of the Council's electricity committee, at a meeting of ratepayers at Chadwell Heath. He said that the estimated cost of street lighting for 1934-35 was £17,500, the number of public lamps being 4,339. The number of domestic consumers was 33,781, an increase of 4,349 compared with the previous twelve months. This continual increase was the more gratifying considering how little commercial load there was to cater for. In

1934 the revenue from domestic consumers was £105,200 out of a total of £204,639. The total capital expenditure on the undertaking up to March 31st, 1933, was £925,410, of which £333,803 had been repaid. There was a reserve fund of £46,271. The amount paid in rates and taxes by the undertaking for the year 1933-34 was approximately £10,459, while its contributions to relief of rates during the last three years totalled £14,449. Some 4,000 cookers were connected.

Baths Heating.—The borough electrical engineer has inspected certain electrical apparatus installed at the new public baths at Watford, in connection with suggestions that electric heating should be used at the Ilford baths.

Loan.—The Electricity Committee is seeking sanction to borrow a further £25,000 for meters.

India.—New Supply Scheme.—It is proposed to install electricity at Veraval, a flourishing seaport with a population of 21,000 in the Bombay Presidency. The cost will be about £15,000.

Kirkcaldy (Fife).—Bulk Supply.—The Town Council has adopted a recommendation to link up with the grid, and to accept the offer of the Central Electricity Board for a bulk supply.

Millport (Ayrshire).—Bulk Supply.—The Town Council has abandoned a project to introduce a bulk supply of electricity from the Ayrshire Electricity Board at approximately £20,000. The advisability of producing electricity locally is being considered, and a questionnaire is to be sent to occupiers of property.

Newport (Mon.).—Extensions Deferred.—After considerable discussion, the Town Council has decided to defer for the time being a scheme for providing extensions at the power station at a cost of £95,000, with the exception of evaporator plant, which is to be purchased.

Paisley.—Street Lighting.—The Corporation Watching and Lighting Committee has decided that the Gallowhill and Barterholm districts be electrically lighted with 100- and 150-W lamps.

Runcorn.—Reduce Charges.—The Mersey Power Co., Ltd., has reduced the flat rate for lighting at Ellesmere Port from 6d. to 5d. per kWh, and in the rural district of Chester and Runcorn and the parish of Ince from 8d. to 6d. per kWh, and for water-heating in all areas to ½d. per kWh.

St. Monance (Fife).—Street Lighting.—The Town Council may shortly adopt electricity for street lighting, and the Town Council has decided to put the whole requirements before the Fife Power Co. with a view to obtaining an estimate for a year's supply. A petition from proprietors in the town demanding underground cables led to considerable discussion, but it was decided that the petition be ignored.

Scarborough.—Sale Declined.—The Corporation Electricity Committee has declined an offer from the Buckrose Light & Power Co., Ltd., to purchase from the Corporation that section of its electricity undertaking which is within the boundaries of the urban district of Filey. The two undertakings are negotiating with regard to further supplies which the company will require this year.

Scotland.—Grampian Finance.—Application has been made by the Grampian Electricity Supply Co. to the Electricity Commissioners for a Special Order to authorise the company to raise additional capital by the creation and issue (wholly or partially) at its option of new shares or stock, and to raise further moneys either by borrowing on mortgage or by the creation and issue of debentures or debenture stocks, and to confer other financial powers upon the company.

South Africa.—A New Cape Scheme.—The Town Council of Laingsburg, Cape Province, has decided on an electric light scheme at a cost of £4,000. The ratepayers' sanction has still to be obtained.

South Shields.—Sub-station.—The Electricity Committee is to erect a sub-station on the West Harton housing estate.

Street Lighting.—The Corporation is to provide "Osira" lighting in Westoe Road at a cost of £200.

Stockport.—Loans.—Of the loan of £750,000 which is to be obtained for various purposes, some £33,000 is required for electricity plant extensions.

Sudbury.—Gas to Electricity.—The local Gas Company has had its tender for lighting the town turned down at a meeting of the Town Council, which decided that electric light would in future be used for public lighting, and a contract was submitted by the East Anglian Electric Supply Co., Ltd.

Sunderland.—Grid Supply Refused.—The Town Council has declined an offer of the Central Electricity Board to supply from the grid the whole of the Corporation's requirements from February to October, inclusive, and a partial supply during the remaining months of the year. The Council has accepted an alternative offer of a three months' full supply during the period when new mechanical stokers are being installed.

Torquay.—Supply to Totnes.—The Electricity Committee is to provide a supply to the borough of Totnes, at a cost of £20,662.

Mains Extension.—The Electricity Committee is to extend 11,000-V distribution mains from Torwood Gardens sub-station to a new sub-station at St. Marychurch, at a cost of £16,750.

Wellingborough.—Overhead-line Inquiry.—A Ministry of Transport inquiry was held on April 12th into the proposal of the Wellingborough Electric Supply Co., Ltd., to erect overhead lines on the Brook Farm housing estate. The lines would operate at 230 V, be 23 ft. above ground, and the poles would be 18 in. wide at ground level. A similar line on each side of the road would avoid cross-road services. The total length projected was 930 yds., and the cost £517; if underground cables were used the length would be 995 yds. and the cost £819. The scheme was opposed by the Urban Council and the landowners, the Wellingborough Iron Co. The chairman of the Council Housing and Town Planning Committee criticised the applicant company's estimate of an annual revenue of 27s. from each house supplied, remarking that if that figure were quoted to the Council electricity would almost certainly be installed in all the 300 houses to be built, whereas the Council had hitherto installed gas. The clerk to the Council submitted that overhead lines should not be erected in urbanised areas. The company could afford to extend its underground cables. It was controlled by the Northampton Electric Supply Co., and the shares stood at 56s. 6d.

Whitby.—Price Reduction.—The Urban District Council has made the following reduction in charges: Lighting, flat rate, 6d. to 5½d. per kWh; shop windows (excess lighting), from 1½d. to 1d.; maximum demand system "unit" charge lowered from 1½d. to 1d.; heating and cooking, reduced to a flat rate of 1d.; power, first 100 kWh per quarter, 3d. per kWh, beyond 2d.; exceeding 3,000 per quarter, 2d., beyond 1½d.

Wimbledon.—Domestic Load Development.—The following table of domestic appliances let out on hire during 1932-33 and 1933-34 by the Corporation Electricity Department indicates the rapid growth in the domestic load of the undertaking:—

	Year ending March, 1933.	Year ending March, 1934.	Total hired at March, 1934.
Cookers	631	786	5,109
Wash Boilers	135	279	1,524
Water Heaters ...	781	1,374	3,952
Irons	222	477	5,379
Kettles	505	698	4,423
Radiators	465	1,158	5,713
	2,739	4,772	26,100

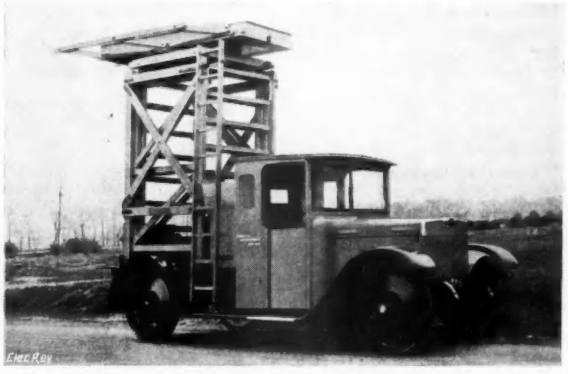
Mr. A. E. McKenzie, the chief engineer and manager, informs us that the 1933 figures were then a record, and last year's figures represent an increase of 74 per cent. over those figures.

Worthing.—Loan.—The Town Council has applied for sanction to a loan of £12,453 for electricity purposes, including the provision of three transformers.

Traction

Aberdare.—Tramway Abandonment?—There is a possibility that the Municipal Council may abandon its tramway system and establish an omnibus service.

Croydon.—Electric Tower Wagon.—The "Electricar" battery-propelled extending-tower wagon which the Corporation Electricity Department has had in service for the past four years has covered some 37,000 miles. In that period the current consumption has averaged 0.975 kWh per mile, which,



An electric tower wagon which has seen considerable service at Croydon

at a cost of 0.5d. per kWh, cannot be considered expensive. The vehicle has never been off the road. The West Ham Corporation Electricity Department, which has had an electric tower wagon in use for twenty years, has ordered a duplicate of the vehicle at Croydon.

Germany.—Trolley Buses in Berlin.—As a result of the success of the first electric trolley bus service in Berlin, that between Spandau and Staaken, it is reported that the Berliner

Verkehrs Gesellschaft has decided to run such vehicles over another route, but is considering the question of replacing a number of electric tramway services by trolley buses.

South Shields.—TRAMCAR CONVERSION.—The Transport Committee of the Corporation is to convert two open-top tramcars into single-deck cars, at a cost of £200, in connection with the proposed service to Laygate.

Communications

Ceylon.—AUTOMATIC TELEPHONY.—The *Ceylon Observer* reports that the Ministry of Communications and Works has instructed the telephone authorities to submit a detailed scheme, together with the estimated cost, for converting the whole of the central telephone exchange system in Colombo to automatic operation. The installation of an automatic system in Colombo, and thereafter in all the outstations, was recommended by the late Chief Engineer of Telegraphs three years ago, but owing to the industrial depression the scheme was shelved for want of funds.

Egypt.—NEW BROADCASTING SERVICE.—A State broadcasting service is to be inaugurated at the beginning of May. Mr. J. B. Clark, the B.B.C.'s director of Empire programmes, who will be in Egypt at that time, is to act in an advisory capacity in connection with the new service.

India.—BOMBAY TELEPHONE CO.—This company has now obtained a site for an automatic telephone exchange at Karachi, and the work of erection will begin immediately. For the year ended December 31st last the company made a profit of Rs. 19,41,129, and a dividend of 7 per cent., tax free, is being paid. During the past year there was an increase of 833 exchange lines and 327 extensions, the largest increase since 1920.

Irish Free State.—TELEGRAPHY AND TELEPHONY.—Reviewing the past year's operations, the Minister of Posts and Telegraphs recently stated that the telegraph income was £162,260, with a deficit of £118,854. The telephone income was £427,239, with a surplus of £41,613. The profit on the combined services was £17,357, as compared with £66,947 in the previous year. During the year automatic telephone exchange lines in Dublin were increased by 143; several new rural exchanges and call offices were opened, the trunk system was being extended, and it was proposed to erect fifty more kiosks this year. The telephone wire mileage was 120,000, representing an increase of 47 per cent. in five years.

BROADCASTING.—Moving a vote of £38,796 for broadcasting during the year 1934-35, the Minister said that it compared with £43,530 this year. The revenue from receiving licences last year was £26,000, and the fees for advertisements and miscellaneous receipts totalled £22,000. The number of licences issued increased by 17,071 to 50,500. Special inspectors were employed to round up defaulters, and there had been 350 prosecutions during the year. Direct expenditure had amounted to £53,230.

Italy.—MOUNTAIN TELEPHONES.—In a recent issue of *L'Energia Elettrica* a description is given by Signor G. Romagnoli Mosca of the special telephone line which has recently been erected by the Societa Elettrica Interregionale Cisalpina in connection with the supervision of its transmission lines in a mountainous district. The telephone line has a length of about six miles, of which 1½ miles are on level ground, the remainder being located in very hilly country only accessible with great difficulty. The level portion of the line consists of two cables, each comprising seven 15.4-sq. mm. section galvanised-steel wires, set at a distance of nearly 6 ft. from each other. The cables are carried on ferro-concrete masts standing about 40 ft. above the ground, the maximum span being 492 ft. On the hilly section of the line two seven-wire cables are also employed, but in this case they are mounted at a distance of nearly 10 ft. from each other on angle-iron masts 52 ft. high, the span averaging about 121 ft.

Great Britain.—MARCONI EQUIPMENT FOR AIRCRAFT.—The two "Scylla" type aircraft which are now being built for Imperial Airways, Ltd., at Rochester are being fitted with a new type of Marconi wireless equipment known as the A.D.41A/42A. It follows very closely the design of the medium-wave portion of the A.D.37A/38A combined medium- and short-wave set, which is installed in all the Imperial Airways "Atalanta" class aircraft. The transmitter and receiver can be installed either as one unit or as two separate units to suit the accommodation available. The wave range of both is 500-1,000 metres, and

The Marconi medium-wave telegraph-telephone set for the new Imperial Airways "Scylla" class aircraft

to facilitate the operation of the set quick wave switching is provided for on four wavelengths, namely, on 600 metres and on any three predetermined wavelengths in the band of 850-950 metres. The transmitter, which employs two magnifier valves with a power to the anodes of approximately 160 W, is suitable for working on both telephony and telegraphy with either fixed or trailing aerials. The weight of the complete transmitting and receiving equipment is approximately 99 lb. Provision has also been allowed for the installation of wing-coil apparatus for "homing" as an aid to navigation.

Northern Ireland.—AUTOMATIC TELEPHONY.—The new automatic telephone system which is now under construction, the main section of which will probably be in use by September, 1935, will first provide an automatic service for the Belfast multi-office area, which includes all subscribers within a five-mile radius of Belfast City centre, about 18,000 telephones and 816 private exchange switchboards, and will cost £600,000. A large central exchange, which will house the various service and technical staffs, and nine automatic exchanges are already under construction. About 36,000 pairs of wires will be led into the new exchanges. Ultimately, the large central exchange will accommodate 10,000 subscribers, and, with the nine satellite exchanges, there will be adequate provision in the whole multi-office area of Belfast for 28,900 subscribers.

Paisley.—RADIO INTERFERENCE.—The Watching and Lighting Sub-committee is in correspondence with the P.O. Engineering Department regarding alleged interference with wireless installations by the present fire alarm system. The P.O. seems to be of opinion that the present overhead system is responsible for the disturbance, and suggests putting the fire alarm circuits into its underground cables at an annual cost of £63. The Sub-committee is making further inquiry.

Russia.—LONG-DISTANCE TELEPHONY.—The projected telephone line from Moscow to Khabarovsk, on the Manchukuo frontier, will be about 6,800 miles long, one of the longest in the world.

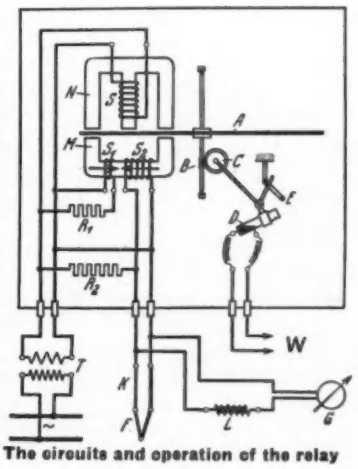
South Africa.—NATAL BROADCASTING STATION.—Mr. R. H. P. Collins, engineer representing the Marconi Company in South Africa, has arrived to carry out tests at World's View, near Maritzburg, where it is proposed to erect the new broadcasting station for Natal.

A Protective Relay for Thermo-electric Devices

THE apparatus shown in the accompanying illustration, from *Elektrotechnische Zeitschrift*, is designed to guard against the consequences of breakage or other open-circuit faults in a thermo-couple. For example, if the latter be used for temperature measurement, an alarm may be sounded when the couple fails; while, if the couple be used for temperature control, the heating circuit of the furnace may be interrupted simultaneously with the sounding of the alarm.

As devised by W. Geyger, the essential feature of the apparatus is an induction meter system with a pressure winding S excited from the 220/40-V transformer T, and two differentially connected current windings S_1, S_2, connected as shown. The thermo-couple F, with compensating leads K, is connected through the choking coil L to the indicating, recording, or controlling instrument G. The meter disc A actuates, through the gears B, C, the mercury switch-tube D, tilting it in one direction or the other between limits fixed by the stops E, and thus operating the alarm and/or trip circuit W.

By suitable choice of the meter windings and of the ohmic resistances R_1, R_2, it can be arranged that the meter disc turns to the left when the thermo-couple is in order, and to the right if the junction breaks or the circuit be otherwise opened. In the latter event the tube D is tipped and the alarm and protective gear are operated. With correctly chosen circuit constants, the shunting effect on the thermo-couple is inconsiderable and the a.c. superimposed on the d.c. in the circuit F G is stated to be unobjectionable.



The circuits and operation of the relay

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Argentina.—Buenos Aires.—May 22nd. National Sanitation Works Department. Two hydro-electric sets, two electric centrifugal pumping sets, and five deep-well pumping sets. (A.Y. 12320.)*

May 11th. Argentine State Oilfields. Material for electric lighting installations. (A.Y. 12330.)*

Australia.—(Brisbane).—June 8th. City Council. Traction sub-station equipment. (A.Y. 12283.)*

Melbourne.—Posts and Telegraphs Department. June 26th. Battery and magneto P.B.X. cordless type, table pattern telephone switchboards. (A.Y. 12317.)*

June 5th. V.i.r. lead-covered cable. (A.Y. 12325.)*

Caithness.—April 23rd. County Council Education Committee. Various works, including heating and electrical, at new school at Lybster. Schedules from architects, Messrs. Sinclair Macdonald & Son, Wick and Thurso (deposit £2 2s.); tenders to D. W. Georgeson, clerk to the Education Committee, Wick.

Cardiff.—April 23rd. Electricity Department. E.h.p. and l.p. switchgear and e.h.p. and l.p. cables. (April 6th.)

Cleethorpes.—April 30th. U.D.C. One 250-kW transformer, e.h.p. switchgear and cable. (April 13th.)

Dartford.—April 27th. Corporation. Cable. (April 13th.)

Dagenham.—April 27th. U.D.C. Electrical wiring, fittings, &c., at the new branch library. (April 6th.)

Dunfermline.—April 23rd. Town Council. Various works, including electric lighting, at forty-four houses at Baldridgeburn. Schedules from Mr. D. H. Shaw, burgh engineer, City Chambers (deposit £1 1s.); tenders to Town Clerk.

Glasgow.—April 23rd. Lighting Department. Materials for one year, including electrical fittings and accessories. Specifications from 20, Trongate; offers to Town Clerk.

May 7th. Electricity Department. Supplies as required for one year of cables, meters and cable tiles. (See this issue.)

Hull.—May 15th. Electricity Department. One 25,000-kW turbo-alternator with auxiliaries. (See this issue.)

India.—Travancore.—June 4th. Government Electricity Department. Turbines, generators, switchgear, transformers, &c. (February 9th.) Date extended from May 7th.

July 9th. 66, 33 and 11-kV circuit lines. (See this issue.)

Simla.—May 10th. Indian Stores Department. Five oil-cooled power transformers. (A.Y. 12305.)*

April 30th. Electrical fittings. (G.Y. 13676.)*

May 3rd. Wall plugs and sockets. (A.Y. 12323.)*

Lancaster.—Electricity Department. Supply, laying and jointing of e.h.p. cables. (See this issue.)

London.—H.M. Office of Works. May 8th. Supply of mechanical and electrical engineering labour in the Newcastle-on-Tyne, Leeds and Southampton districts for three years. (April 13th.)

Manchester.—April 23rd. Electricity Committee. Transformers, meters, kettles, time switches, a.c. motors, cables, and service cut-outs for twelve months. (April 13th.)

New Mills.—May 3rd. Electricity Department. Underground e.h.p. and l.p. cables, together with electrical equipment. (See this issue.)

New Zealand.—Wellington.—Posts and Telegraphs Department. April 30th. Eighteen double-pole, single-throw contactors. (A.Y. 12250.)*

May 7th. Thirty-seven moving-coil milliammeters and one voltmeter. (A.Y. 172272.)*

Public Works Department. May 29th. One 33-kV oil-immersed circuit-breaker. (A.Y. 12276.)* Three single-phase potential transformers. (A.Y. 12274.)*

June 26th. Battery-charging equipment. (A.Y. 12273.)*

May 8th. 6-V secondary batteries. (A.Y. 12244.)*

May 1st. Transformer oil drying and testing apparatus. (A.Y. 12252.)*

May 22nd. Battery-charging equipment. (A.Y. 12249.)*

June 5th. 50-V storage battery and charging equipment. (A.Y. 12245.)*

May 8th. Three 63,500/63.5-V oil-immersed self-cooled transformers. (A.Y. 12303.)*

Ormiston.—April 30th. East Lothian County Council. Various works, including electrical, at new schoolhouse. Schedules from County Architect, Property and Works Department, Haddington; tenders to G. Cruickshank, county clerk, County Buildings, Haddington.

South Africa.—Pretoria.—May 4th. Government Supplies Board. Four-cord circuit repeaters. (A.Y. 12298.)*

Lead-covered underground telephone cables. (A.Y. 12306.)*

Johannesburg.—May 11th. Municipality. 600 300-A, 6,600-V isolating links. (A.Y. 12329.)*

Southampton.—April 24th. Electricity Department. 2,000-kW rotary convertor, complete with transformer, starting panel, &c. (April 13th.)

South Shields.—May 2nd. Electricity Supply Department. One 1,000-kW rotary convertor complete with transformer and switchgear. (April 13th.)

Taunton.—May 11th. Electricity Department. One 3,750-kW turbo-alternator and one 25,000-lb. water tube boiler. (April 13th.)

Weymouth.—April 30th. Electricity Department. E.h.p. and l.p. overhead and underground mains. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bournemouth.—Town Council. Accepted. Machinery and plant for a lift at Southbourne (£1,250).—Express Lift Co.

Barrow-in-Furness.—Electricity Committee. Accepted. Voltage regulator.—English Electric Co., Ltd. Switches, switch sockets and plugs.—Downes & Davies. Lampholders and cooker control units.—J. A. Crabtree & Co., Ltd. Fuse boards.—G. P. Dennis, Ltd. Cut-outs and irons.—General Electric Co., Ltd. Kettles.—Premier Electric Heaters, Ltd. Tapes.—Pirelli General Cable Works, Ltd. Insulating compound.—Dussek Bitumen & Taroleum, Ltd. Meters.—Landis & Gyr, Ltd.; Metropolitan-Vickers Electrical Co., Ltd. Transformers.—Electric Construction Co., Ltd. Disconnecting boxes.—W. T. Henley's Telegraph Works Co., Ltd. Insulators.—Johnson & Phillips, Ltd.; Electric Transmission, Ltd. Cables.—Derby Cables, Ltd. Wire.—Richard Johnson & Nephew, Ltd. Cables, ceiling roses, conduit and miscellaneous wiring supplies.—W. R. Thornton, Ltd.

Dartford.—Electricity Committee. Recommended. Rectifier equipment (£1,895).—Hewittic Electric Co., Ltd.

Epping.—Essex Public Assistance Committee. Accepted. Electric lift at the Infirmary.—J. & E. Hall, Ltd.

Fife.—County Council. Finance Committee. Accepted. Electrical work at housing scheme (£194).—J. Scott & Co.

Glasgow.—Education Committee. Accepted. Electrical work at Thomson Street school (£237).—Kennedy, Stark & Co.

Public Assistance Committee. Accepted. Electrical work in buildings at Lennox Castle Institution (£17,678).—J. Kilpatrick & Son, Ltd.

London.—(Ealing).—Education Committee. Accepted. Electrical installation at St. John's schools (£255).—Twentyman & Willmott, Ltd.

Manchester.—Transport Committee. Accepted. Supply for twelve months:—Section insulator, insulated bolts, and h.t. cable for motor buses.—British Insulated Cables, Ltd. Electrodes.—Equipment & Engineering Co., Ltd. Cable.—W. T. Glover & Co., Ltd. Arc deflectors, electrodes and pinion wheels.—Metropolitan-Vickers Electrical Co., Ltd.

Housing Committee. Accepted. Electrical installation work at houses: 250 on the Wythenshawe Estate and sixty-two at Burnage.—H. C. Taylor & Co., Ltd.

Portland.—Electricity Committee. Accepted. Meters.—Ferranti, Ltd.; British Insulated Cables, Ltd.; Electrical Apparatus Co.; Landis & Gyr.

Walton and Weybridge.—U.D.C. Accepted. Cable (£319).—Edison Swan Cables, Ltd.

Winchester.—City Council. Accepted. Installation of traffic signals (£302).—Automatic Electric Co.

Wolverhampton.—Electricity Committee. Accepted. Transformers for twelve months.—Electric Construction Co., Ltd.

Forthcoming Events

Birmingham Electric Club.—Friday, April 20th. Grand Hotel, Birmingham. 7 p.m. "Modern Broadcast Receiving Valves." Mr. F. E. Henderson.

Bristol Electric Club.—Friday, April 20th. Royal Hotel, Bristol. 6.30 p.m. Annual meeting.

Electrical Industries Benevolent Association.—Friday, April 27th. Cafe Royal, W.1. 12.30 p.m. Annual meeting.

Institute of Fuel.—Wednesday, April 25th. Institution of Mechanical Engineers, London. 6 p.m. "The Velox Steam Generator; a Supercharged Boiler." Mr. Adolph Meyer.

Institution of Electrical Engineers.—Thursday, April 26th. Institution, London. 6 p.m. Kelvin lecture. "Electrical Phenomena at Extremely Low Temperatures." Prof. J. C. M'Lennan. (*London Students' Section*).—Tuesday, April 24th. 1.15 p.m. Visit to Broadcasting House, W.1. Friday, April 27th. Institution, London. 6.15 p.m. "Train Lighting." Mr. C. I. Gould.

Batti-Wallahs' Society.—Thursday. April 26th. Hotel Metropole, London. 12.30 for 12.55 p.m. Luncheon. Address by Lord Iliffe, C.B.E.

Screw Lamp Caps and Lampholders

For many years the International Electrotechnical Commission has been endeavouring to secure agreement with regard to the dimensions of the Edison-type screw lamp caps and holders.

A large measure of international agreement has now been reached and embodied in British Standard Specification No. 98, which has just been published. The 1919 edition dealt only with the "Goliath" size, whereas the new edition deals with the "Goliath," medium, small and miniature sizes, and goes into much greater detail.

An important clause requires that all "Goliath" and medium lampholders shall be so constructed that it is impossible to touch the lamp cap or any live metal when inserting or removing a lamp. Copies of this new specification (B.S. No. 98-1934) may be obtained from the British Standards Institution, Publications Dept., 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Notes

The Electrical Engineers' Ball

The Committee of Management of the I.E.E. Benevolent Fund announces that the Fund has benefited to the extent of about £210 as a result of the Ball held in February, this being the surplus available after defraying all expenses. The attendance was over 800.

Power in Cotton Mills

In a recent lecture before the British Association of Managers of Textile Works, Mr. F. B. Holt (textile engineer, Met.-Vick Co.) suggested that the fixed charges on capital invested by the millowner on account of his power supply should be varied according to whether this was derived from reciprocating engines, turbines, or the public mains. Interest and depreciation were both assumed to be 5 per cent. in every case, but the percentages of repairs and maintenance were taken as 3, 2½, 1 in the order of reference, and rent, rates and insurance at 3½, 3 and 2, giving totals of 16½, 15½ and 13 per cent.

Standard Steel-cored Aluminium Conductors

The revised British standard specification for aluminium and steel-cored aluminium conductors, just published, presents some interesting features. It retains the standard forms of construction, but the tables of weights and resistances have been completely recalculated on the basis of the theoretical increase in length of each individual wire due to the effect of stranding. The specification is very informative and an important amendment has been introduced regarding the jointing of wires in a stranded conductor.

Copies of the specification (B.S.S. No. 215-1934) may be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

The Overhead Lines Association

In September next this Association will cease to exist as an independent organisation. Following a plebiscite of its members a special meeting has authorised the merging of the Association with the proposed Transmission Section which the Institution of Electrical Engineers contemplates forming.

The Trend of Invention

In the course of his report for 1933 (Stationery Office, 4d. net) the Comptroller-General of Patents says that in the electrical field there is steady development in connection with the use of mercury-arc and other gaseous-discharge devices in place of rotating commutators and in their application to a.c. and d.c. networks. Motor control systems are being introduced in which mercury-arc rectifiers, &c., are used in place of control switches. Discharge lamps with high pressure vapour fillings have been the focus of much inventive effort, and the results obtained indicate that these lamps constitute an important step in lighting technique. There is much activity in connection with cathode-ray tubes, particularly for television work, and also in oscillation generators for use with these tubes. The application of the photo-electric cell in diverse arts continues. In the wireless art, radio valves of "multiple" form have been noticeably developed, and attention is being directed to short-wave signalling, particularly for aerial navigation, to varying the induction in tuning coils by varying the permeability of the cores, to super-heterodyne broadcast receivers, and to receivers utilizing volume control to reduce the effects of fading. Development in connection with the electrical precipitation of dust, &c., from gases continues. There is also noticeable activity in such subjects as heat accumulator cooking-stoves, vacuum cleaners and glass bulb photo flash lamps.

There was a decrease in the number of applications for patents from 37,052 in 1932 to 36,734 last year, and the number of patents sealed fell from 21,150 to 16,568. There was an increase in the number of registered designs, but the trade mark registrations declined.

"Telephone Service Dinner"

A "telephone service" dinner was held at Grosvenor House, W.1, on Tuesday to celebrate the ten years' work of the Telephone Development Association. Sir William Noble (chairman), proposing "The British Telephone Service," referred to the Post Office as one of the biggest business organisations in the world, as it employed 250,000 workers and had a capital of about £150 million. He expressed the view that the Postmaster-General should always be a Cabinet Minister. Sir Kingsley Wood (Postmaster-General), responding, said that our Post Office engineers and their designs were second to none in the world. The British telephone industry was able to meet all demands and less than 0.5 per cent. of the value of the electrical goods used by the P.O. now came from abroad. During the past eight years the average annual expenditure on telephone development had been £10 million. We had some lee-way to make up in this country, but new connections in 1933-1934 constituted a record and the number of disconnections had been far less than in any other country. Automatic telephones now numbered 800,000, and a subscriber could speak to 32 million out of the 34 million stations in the world. He hoped it would be possible to speak directly to Japan by the end of the year. Ninety-five per cent. of orders for new connections were completed within, at the most, a week and often within a few hours. The grant for publicity this year was the largest yet made. Advertising in the Press had been proved to pay for itself over and over again, and it was more necessary to advertise in bad times than in good. Sir Arthur Stanley, in proposing "Our Guests," stated that there had been an increase of 85,000 subscribers last year, and that the Post Office used over 60 per cent. of the apparatus made by members of the T.D.A. Brief replies were made by Colonel Donald Banks (Director-General of the P.O.), Major C. R. Attlee and Sir John Cadman. The health of the chairman was proposed by Mr. Frank Gill.

High-frequency Radio Diffusion

Among the new clauses proposed in the committee stage of the Electricity (Supply) Bill was one to enable authorised undertakings to make agreements with other parties for the use of public distribution systems to relay not fewer than two radio programmes simultaneously. Mr. Liddall (Lincoln), in moving that the clause be read a second time, stated that the system he had in mind covered the simultaneous distribution of three or more programmes at supersonic frequency. The apparatus necessary (to be provided and maintained by the Wireless Exchange Organisation) would include receiving sets and transmitters as well as loud speakers. In this the high-frequency rediffusion system differed from that of the 200 existing relay companies, which used special overhead wires and distributed one or two programmes only, at audio frequency. This h.f. system, which had been developed by British Insulated Cables, Ltd. (and was the one proposed last year for the Middlesbrough Corporation scheme) had been successfully installed on a portion of the Liverpool Corporation network. The clause was ultimately withdrawn on the ground that the present Bill was not appropriate to a clause of the character under discussion.

Flame-proof Apparatus Tests

It was with a view to assisting mine managements to comply with the regulations governing the use of electrical apparatus below ground under the Coal Mines Act, 1911, that the Mines Department, in July, 1931, took over from the Mining Department of Sheffield University the work, which the latter had voluntarily undertaken, of testing and certifying types of electrical apparatus designed and constructed to prevent the ignition of inflammable gas by open sparking. In addition to apparatus for the coal mining industry, apparatus is tested for other industrial uses, *e.g.*, in the petroleum industry and for processes involving the use of cellulose spray paint. Already over 200 flameproof certificates covering a wide range of apparatus have been granted by the Mines Department, and as a result of the experience gained, it has now become possible to formulate in general terms the constructional requirements for electrical apparatus intended for use in industries where inflammable gas is a hazard. The memorandum just published (No. 4, Testing. H.M. Stationery Office, price 2½d., post free) explains, in addition to the procedure to be followed and the fees to be paid when submitting apparatus for test and certification, the general principles of flameproof construction which are insisted upon, the manner of preparation of the drawings to be submitted with each application, and the character of the tests applied.

A Ten-ton Magnet

The Royal Society has made a grant of £1,000 to the Birkbeck College on behalf of Professor Blackett, well known for his research in the field of cosmic radiation, for the construction of what will be one of the largest magnets in this country, for use in connection with researches on cosmic radiation. The magnet, which will weigh ten tons, will, it is hoped, be ready shortly. It was not considered desirable to house the magnet near Birkbeck College itself because of the tall neighbouring buildings, which would have the effect of cutting off some of the radiation. For this reason it has been agreed to allocate a small portion of the Bloomsbury site for the purpose.

Railway Supplies from the Grid

Sir Philip Dawson has communicated to *The Times* his objections to the Electricity (Supply) Bill now before the House of Lords. He states that the provisions under Clause 1, that the Central Electricity Board may control and take supplies from non-selected stations on terms to be mutually agreed, may result in preferential and uneconomic prices, the burden of which will be borne by the rest of the industry. For the same reason he objects to Clause 4, which empowers the Board to supply railways direct on terms to be agreed, pointing out that under the 1926 Act railways were placed in the same position as supply undertakings in regard to the price of energy, although they do not contribute to the expenses of the Electricity Commissioners or of frequency standardisation. He regards the protection proposed for owners of selected stations as illusory, as these can quote only on terms laid down in the 1926 Act.

Makers' Names Wanted

CUTAWL electrical machine for cutting beaverboard, &c.
SUNHOUSE electric fire.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. R. Hodge, of the Metropolitan-Vickers Electrical Co., Ltd., Bristol, has been nominated for the chairmanship of the Western Centre of the Institution of Electrical Engineers for the session 1934-35.

Mr. E. A. Cartwright

Mr. E. A. Cartwright has been appointed by the Carborundum Co., Ltd., Trafford Park, Manchester, to represent it in Lancashire, Cheshire and North Wales for carborundum and "Aloxite" brand grinding wheels. Mr. Cartwright has been connected with the Carborundum Co., Ltd., for over twelve years.

Mr. G. R. J. Parkinson has been presented by the employés of the Midland Electric Corporation for Power Distribution, Ltd., with a silver salver and two oil paintings as a token of appreciation and affection upon his retirement from the position of manager and engineer.

Mr. A. M. Johnston, Forfar, has left for Tanganyika, East Africa, where he will be engaged for two and a half years on work for Messrs. Balfour, Beatty & Co., Ltd. During the past three years Mr. Johnston has been employed by the company in Derbyshire.

At the annual meeting of the Institution of Electrical Engineers (North-Eastern Area) held at Newcastle-on-Tyne **Mr. L. E. Mold,** of Messrs. A. Reyrolle & Co., Ltd., Hebburn, was elected chairman of the North Eastern Centre of the I.E.E. for the ensuring year. It was reported that during the past year the membership had risen from 598 to 613 (including the Tees-side sub-section). **Mr. E. C. Rippon** was awarded a premium for the best paper read during the year, this being "The Design and Economics of Transformers for Rural Electrification," while **Mr. N. H. Denholm's** paper "Applications for Electricity in Ships," was adjudged the best read to the Students' Section.

At the National finals of the E.D.A. Public Speaking Competition held at the Caxton Hall on April 13th, the following awards were made: *Ladies:* 1st, Miss Gladys A. Young (North Metropolitan E.P.S. Co., Bishop's Stortford); 2nd, Miss C. Robertson (Birmingham Electric Supply Department). *Men:* 1st, Mr. A. Beckingsale (Central Electricity Board, Swansea); 2nd, Mr. E. A. Anderson (A. Anderson & Son, Middlesbrough); 3rd, Mr. E. J. A. Leroy (Brompton & Kensington Electricity Supply Co., Ltd.). With the exception of Mr. Leroy, who spoke on "How Electricity is Revolutionising Industry," all the successful competitors took "Electrical Development as a Factor in Social Evolution" as their subject. The judges were the Dowager Lady Swaythling, Sir James Hawkey, J.P., Mr. J. M. Kennedy, and Mr. G. S. Francis. The general standard of this year's competition was noticeably higher, both in matter and in presentation, than it was last year.

Miss G. A. Young and Mr. A. A. Beckingsale, A.M.I.E.E., winners of the E.D.A. Public Speaking Competition

Sir Francis Goodenough is accepting for a second year the presidency of the National Association of Trade Protection Societies. Lord Meston, who was president for three years, will be elected vice-president at the annual conference on May 8th and 9th.

Mr. J. G. Kellie, M.Eng., A.M.I.E.E., has been appointed chief assistant electrical engineer to the Ealing Corporation Electricity Department. There were sixty-six applications for the post. For the post of assistant electrical engineer the Corporation have approved the appointment of **Mr. R. Devereux,** B.Sc. (Eng.), A.M.I.E.E.

Mr. F. G. Hancock, for five years resident engineer at Witham for the East Anglian Electric Supply Co., Ltd., has taken up a similar appointment at Haverhill, and on leaving has been presented by his colleagues with a clock.

Mr. G. Rogers, superintendent of Posts and Telegraphs at Cape Town, left South Africa recently for a holiday in England. He is accompanied by Mrs. Rogers.

Guglielmo Marconi, G.C.V.O., LL.D., D.Sc., who will celebrate his sixtieth birthday on April 25th, was born at Bologna in 1874. He was educated privately at Bologna, Florence, and Leghorn. In the early summer of 1895 he conducted a number of experiments at his father's country house at Pontecchio, near Bologna, with results which were pointed out in his first patent and were also clearly described in a letter dated November 14th, 1896, addressed by him to Mr. (afterwards Sir) William Preece, engineer-in-chief of the British Post Office. In 1896 Marconi came to England and took out the first patent ever granted for wireless telegraphy based on the use of electric waves. In the same year he demonstrated his invention before officials of the Post Office and other representatives of British and Foreign Government departments, ranges of two, then of four, and afterwards of nine miles being obtained. In June, 1897, at the invitation of the Italian Government, he went to Spezia, and communication with Italian warships was established up to a distance of twelve miles. A company was formed in London in July, 1897, to acquire the Marconi patents in all countries except Italy. Wireless telegraphy was first used for commercial purposes in 1898, when the Kingstown regatta races were reported by means of apparatus installed on a tug. In the same year installations were also established on the East Goodwin lightship and the South Foreland lighthouse, separated by a distance of about twelve miles. In March, 1898, Marconi established communication across the English Channel between England and France, and also used wireless in the naval manœuvres over distances of seventy-four miles. The first military application took place during the South African war. During this period numerous improvements embodied in patents were utilised. On December 12th, 1901, he succeeded in transmitting and receiving signals across the Atlantic Ocean from Poldhu, in Cornwall, to St. John's, Newfoundland, and in 1902 he patented a practical form of magnetic detector which replaced the coherer, while he took out his patents for the horizontal directional aerial in 1905. Assisted by Mr. H. J. Round in 1910, he received signals and messages at Buenos Aires from Clifden (Ireland), and in 1912 he devised a new method for generating continuous waves, commonly known as "the timed spark system," and by its means sent the first messages from England to Australia on September 22nd, 1918. In 1916 experiments were commenced in Italy with very short waves with the object of devising a directive beam system, and later in England, with the assistance of Mr. C. S. Franklin, important results were obtained. In 1919 the King of Italy appointed him plenipotentiary delegate to the Peace Conference in Paris, and in June, 1929, he was created a hereditary marquis by the King of Italy.

The Marchese Marconi

Mr. W. H. Taylor, general manager of the West Australian Government Electricity Supply Department, has arrived in England in connection with the proposed extensions to the East Perth power station. A loan of £400,000 for this work has now been approved by the Federal Loan Council.

Mr. J. N. Foreman, manager of the Bicester branch of the Wessex Electricity Co., and formerly manager at Faringdon, who was recently married to Miss M. W. Walker, has been presented by his colleagues with a barometer.

Sir Frank E. Smith, K.C.B., F.R.S., is to be presented with the Faraday Medal (twelfth award) at the ordinary meeting

of the Institution of Electrical Engineers to be held on April 26th. The presentation will precede the twenty-fifth Kelvin Lecture, which will be delivered by **Professor J. C. M'Lennan,** D.Sc., F.R.S., on "Electrical Phenomena at Extremely Low Temperatures."

Mr. J. N. R. Perks, M.A., M.I.E.E., informs us that he has resigned his partnership in Messrs. G. V. Twiss and Partners, consulting engineers. Mr. Perks, who has an intimate knowledge of the electricity supply industry, served his apprenticeship with Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park, and was later associated with Mr. G. V. Twiss in the British Power & Light Corporation, Ltd.

Mr. J. Snow Huddleston was presented with a rose bowl and other gifts in recognition of his services as honorary secretary of the Association of ex-Siemens men at the annual smoking concert recorded under "Social Events" in our "Business Notices" to-day.

Mr. A. Bailes has been appointed sales promoter for Northern England for "Relma" lamps with Messrs. H. C. Rawson (Sheffield and London), Ltd. He was at one time area lamp sales superintendent for B.T.-H. and, latterly, for Kye Electrical, Ltd.

Mr. G. B. Wood has been appointed agent for Scotland for Messrs. Trevelyans (Birmingham), Ltd. His address is 141, Bath Street, Glasgow, C.2, where he will carry stocks of the company's manufactures.

Obituary

Dr. O. von Miller.—The death occurred in Munich, on April 9th, of Dr. Oscar von Miller, president of the World Power Conference. Born in 1855, he entered Government service, and visited the First International Electrical Exhibition in Paris in 1881 as Commissioner for Bavaria. In Munich he was the instigator of the first German electro-technical exhibition, which was held in 1882 at the Glaspalast in that city. After travelling in the United States, where he made the acquaintance of Edison, he left the Government service and took over the technical management in Berlin of the German Edison Co. for applied electricity, on which later the Allgemeine Elektrizitäts Gesellschaft was founded. In 1890 he returned to Munich and established there an engineering office for the design and erection of power stations. Early in the following year he was entrusted with the carrying out of the international electro-technical exhibition at Frankfort o/M. In 1903 his scheme for the unification of the power stations of the Palatinate, to form a combined supply system, was carried out. A similar scheme was developed by him, during the years of the War, for that part of Bavaria situated on the right bank of the Rhine; this was carried through to form the Bayernwerk in conjunction with the Walchensee power plant, which was likewise planned by him. He took an active part in the work of the World Power Conference, and was elected honorary president in 1930 in succession to Lord Derby. He was universally known as the founder of the Deutsches Museum of eminent achievements in physics and engineering in Munich in 1903.

Mr. W. F. Ford.—The death occurred at Shoreham, Sussex, on April 12th, of Mr. W. F. Ford, of Marconi's Wireless Telegraph Co., Ltd., in his sixty-first year. Formerly an official of the General Post Office, Mr. Ford joined the Marconi Co. in December, 1921, and went to Peru as assistant to Sir William Slingo, who was then administering the postal and telegraph services of that country under the Marconi Co.'s contract. In January, 1925, Mr. Ford was appointed Administrator-General of the Peruvian Posts and Telegraphs, a post which he held until November, 1928, when he joined the Marconi Co.'s staff of foreign representatives with the special title of "Foreign Director" for South America. He was in Peru until early this year—following a short period at home last summer—when ill-health necessitated his return to this country for an operation in February, from which he never completely recovered.

Mr. H. J. Chalmers, sub-station superintendent in the St. Pancras Borough Council electricity undertaking, died on April 12th at the age of sixty-two years. He joined the undertaking in 1900, and was eventually appointed station superintendent at the Council's Longford Street generating station. Upon the conversion of this station into a sub-station he was given control of all the Council's rotary sub-stations with the designation of sub-station superintendent. He had been absent from duty since September last, and owing to his continued ill-health the Council had already decided to superannuate him at June 30th next.

Mr. J. Thompson.—The death occurred on the liner *Laconia*, in the Mediterranean, on Sunday, of Mr. James Thompson, senior governing director of the John Thompson Associated Engineering Corporation, of Wolverhampton. He was seventy-one years of age.

Mr. H. W. Strawson.—Mr. H. W. Strawson, a director of the Thames Electric Co., Ltd., of Kingston-on-Thames, died on April 13th, after an operation which followed six days' illness.

Mr. L. F. Tucker, secretary of Marconi Sports Club, Chelmsford, was killed in a collision at Brentwood, Essex, on April 13th. He was motor-cycling home when his machine came into collision with a car.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Morgan Crucible Co., Ltd.—Registered as a "public" company on April 11th, with a nominal capital of £4,237,000 in 1,000,000 5½ per cent. cumulative 1st preference, 1,079,000 5 per cent. cumulative 2nd preference, 2,000,000 ordinary and 158,000 "B" ordinary shares, all of £1. Objects: To acquire the business of manufacturers of and dealers in crucibles, &c., and similar accessories for the electrical trade, and generally the undertaking and all or any of the properties, assets, rights, powers, liabilities and duties of the Morgan Crucible Co., Ltd.; to adopt an agreement with the said old company. The 158,000 "B" ordinary shares are to be issued to Doulton & Co., Ltd. The directors are: S. Beeton, Corbie Wood, St. George's Hill, Weybridge (director of Brompton & Kensington Electricity Supply Co., Ltd.); A. R. Bosman, Woodside, Windlesham, Surrey (director of Doulton & Co., Ltd., and Universal Grinding Wheel Co., Ltd.); W. F. Coaker, 4, Queen's Ride, Barnes Common, S.W.13; G. W. Edward, 20, Inner Park Road, Wimbledon Common, S.W.; L. S. Emms, 38, Alleyn Road, Dulwich, S.E.21; L. J. E. Hooper, Queen Anne's Mansions, St. James's Park, W.1 (chairman and managing director of Doulton & Co., Ltd.); P. Lindsay, Chetwode Priory, Buckingham; G. K. Peto, 15, Gt. College Street, S.W.1; C. W. Speirs, The Chesters, Traps Lane, New Malden, Surrey. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

R. & P. Electrical Co., Ltd.—Private company. Registered April 13th. Capital, £1,000 in £1 shares. Objects: To acquire the business of electrical engineers, carried on by Jas. E. Robotham and Alfred E. V. Pinnock, at Spencer Street, and 3, Station Road, Bognor Regis, as "Robotham & Pinnock." The permanent directors are: J. E. Robotham, Hambleton, Kenilworth Road, Bognor Regis, and A. E. V. Pinnock, Nyewood Lane, Bognor Regis.

Forward Radio, Ltd.—Private company. Registered April 11th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless components and parts, &c. The directors are: A. Hoffbrand, 21, Wharncliffe Road, Frizinghall, Bradford, and J. Needham, 78, Queen's Road, Hyde Park, Leeds. Registered office: 7, Dewsbury Road, Leeds.

Daphos, Ltd.—Private company. Registered April 13th. Capital, £200 in £1 shares (150 ordinary and 50 preference). Objects: To carry on the business of electricians, dealers in and manufacturers and distributors of electrical appliances, contractors for lighting, heating and power, &c. The first directors are: C. W. Minty, 36, Powis Square, W.11 (permanent managing director and chairman); I. R. J. Mumford, Green Meadow, Gt. North Road, Welwyn; M. J. Willmott, The Cedars, Basingbourne, Cambs. Registered office: St. Paul's House, 49/50, Newgate Street, E.C.1.

"Diamond H" Switches, Ltd.—Private company. Registered April 14th. Capital, £3,000 in £1 shares. Objects: To acquire the right to use the words "Diamond H" as part of the name of the company and any trade marks relating to such words used in connection with electric and other switches in the U.K. of Great Britain and Northern Ireland and elsewhere, and to carry on the business of manufacturers of and wholesale and retail dealers in electric and other switches, brushes, appliances, &c. The first directors are: G. H. Hart (permanent governing director and chairman), address not stated; C. A. Turner, 33, Crespigny Road, Hendon, Middlesex; and H. W. Petherick, 3, Hazelwood Lane, Palmers Green, Middlesex. Solicitors: McKenna & Co., 31/4, Basinghall Street, E.C.

Ubisigns, Ltd.—Private company. Registered April 13th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with Stewart A. Senior and Arthur B. Chapman; to purchase an invention for improvements in or relating to advertising and the like signs, and to carry on the business of manufacturers and erectors of electric signs, &c. The first directors are: C. B. Roper, Moorbrook, Sandygate, Sheffield, and three others. Solicitors: Wing, Keer & Bolsover, 70, Queen Street, Sheffield.

Kearney Brothers, Ltd.—Private company. Registered in Dublin March 28th. Capital, £5,000 in 3,000 preference and 2,000 ordinary shares of £1 each. Objects: To acquire the business of a radio service dealer, electrical engineer, &c., now carried on by Jemina F. Kearney at 14, Capel Street, Dublin, as Kearney Bros. The first directors are: Jemina F. Kearney, Nora E. Kearney and J. A. Kearney, all of Hatherton, Milltown, Co. Dublin.

Samwell, Smith & Co., Ltd.—Private company. Registered in Edinburgh April 9th. Capital, £2,000 in 1,000 7½ per cent. non-cumulative redeemable preference and 1,000 ordinary shares of £1 each. Objects: To carry on the business of radio, electrical and gramophone engineers, &c. The first directors are: H. P. Samwell, The Rectory, Kerse Lane, Falkirk, and W. J. Smith, 30, Anderson Drive, Denny. Registered office: 36, Stirling Street, Denny.

Station Radio, Ltd.—Private company. Registered April 12th. Capital, £200 in £1 shares. Objects: To carry on the business

of radio and television engineers, dealers and merchants, electrical engineers, electricians, &c. The first directors are: Mrs. J. Terry and Mrs. M. E. Terry, both of Rossendale, Irlam Road, Flixton, Lancs. Solicitor: J. Prior, 7, Brazennose Street, Manchester.

G. R. Lee & Co., Ltd.—Private company. Registered March 29th. Capital, £1,000 in £1 shares. Objects: To carry on the business of wholesalers, retailers, manufacturers, importers and exporters of and dealers in wireless sets and apparatus, electrical equipment, gramophones, &c. The directors are: Mrs. R. Levy, 71, York Road, Battersea, S.W.11; and J. Eldridge, 29, Urswicke Road, Battersea, S.W.11.

F. D. Forbes & Co., Ltd.—Private company. Registered April 4th. Capital, £500 in £1 shares. Objects: To carry on business as electrical, radio and mechanical engineers, &c. The directors are: F. D. Forbes (permanent managing director) and Mrs. Edna V. Forbes, both of 18, Court Hill, Sanderstead, Surrey; and Harold W. Eagle, 105, Waddon Road, Croydon, Surrey.

Borris Electricity Supply Co., Ltd.—Private company. Registered in Dublin March 26th. Capital, £1,000 in £1 shares. Objects: To carry on the business of an electric lighting and power supply company in all its branches. The directors are: Dr. E. Dundon, Borris, Co. Carlow; and M. J. Murphy, Mill House, Borris, Co. Carlow.

Returns of Electrical Companies

Schall & Son, Ltd.—(A) Particulars filed of £10,500 debentures, authorised March 20th, and covered by trust deed of same date, the whole amount being now issued. Property charged: The company's undertaking and property, including any uncalled capital, and premises in Marylebone, and a capital redemption policy (subject to prior mortgage). Trustees: E. Humphrey, 43-4, Broad Street Avenue, E.C., and B. E. Wood, "Ardath," Hastings Road, Bexhill-on-Sea. (B) Land registration charge of same date on 8 and 9, Bulstrode Mews, and 18, Crosskeys Mews, Marylebone, as collateral security to the above trust deed. Holders: E. Humphrey and B. E. Wood.

E.S.S. Signs, Ltd.—The nominal capital has been increased by the addition of £5,500 beyond the registered capital of £500. The additional capital is divided into 2,500 ordinary and 3,000 7½ per cent. cumulative preference shares of £1.

Bulle Co., Ltd.—Particulars filed of £1,500 debentures, authorised March 16th, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Sovereign Products, Ltd.—Particulars filed of debentures not exceeding £2,500, authorised March 21st, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £2,000.

Landis and Gyr, Ltd.—Further charge and deed of variation dated March 23rd, 1934 (supplemental to mortgage dated November 24th, 1928), to secure advances not exceeding £10,000. Property charged: Land with "Elgee Works" thereon at Acton, Middlesex. Holders: A. E. J. Legge, c/o C. Hoare & Co., 37, Fleet Street, E.C.3, and others.

Drake & Gorham, Ltd.—Capital, £125,000 in £1 shares. Return dated November 22nd, 1933. All shares taken up. £85,000 paid. £40,000 considered as paid. Mortgages and charges, £68,667.

Simplex Conduits, Ltd.—Capital, £100,000 in 10,000 preference shares of £5 and 50,000 ordinary shares of £1. Return dated November 7th, 1933. 10,000 preference and 40,000 ordinary shares taken up. £50,000 paid on the preference shares. £40,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

City Notes

The Telegraph Construction & Maintenance Co., Ltd., held its annual meeting on April 12th, when Mr. C. F. Campbell (chairman), who presided, said that the consolidation of the works at Greenwich had been successfully accomplished. In the year under review they secured the larger proportion of submarine cable orders, but the total amount of cable made was under a thousand miles, as compared with an average of about 2,500 miles over the previous five years. Among the orders received and executed was one for a cross-Channel lead-covered telephone cable for the Post Office between St. Margaret's Bay and Calais. This was carried out in conjunction with Standard Telephones & Cables, Ltd. The prices obtained for this and for other cables were rather low, and it had not been possible to cover the overhead expenses in full, but had it not been for the heavy maintenance expenses of their two cable ships and the holding up of their machines towards the end of the year by the unexpected and unprecedented failure in the delivery of certain materials required for the manufacture of cables on which they were engaged, he believed the adverse balance in the profit and loss account would have been largely wiped out. They had been compelled to consider the possibility of a greater reduction in future in the orders for submarine cables than appeared probable two years ago. They had consequently made further big reductions in the standing charges, and when these took full effect, the total reduction made to date would amount to approximately £100,000, representing about 60 per cent. of the standing charges in 1931. Of their cable steamers it had been decided to put the *Telconia* up for sale, while it might be necessary to dispose of the *Dominia* as well. The scarcity of orders for submarine cables reacted upon the output of gutta percha from their plantation in the Federated Malay States. Accordingly, the expenses of the Selborne plantation had been reduced to the lowest possible point until the demand for gutta percha revived. The production of metallic alloys made in induction furnaces, and especially "Mumetal," had proved to be very valuable to the electrical industry, and the turnover had multiplied many times in the past few years. The prospects for the current year seemed to be even better. During the past year they decided to take up the production of lead-covered paper-insulated power cable; a new factory had been erected and machinery installed, and they were actually in production, and were engaged on an order for stranded conductor made with wire produced in their new wire-drawing shops. The advantage of this new development was that it absorbed a certain proportion of their submarine organisation and gave continuous employment to their factory, instead of the intermittent employment which was so characteristic of submarine cable work at present.

Associated Electrical Industries, Ltd., held its annual meeting on April 12th, Sir Felix Pole (chairman) presiding. In presenting the report and accounts (Electrical Review, April 13th, page 543), the chairman said that at the last meeting he stated that the outlook was not reassuring, that adverse trading conditions continued to prevail, and that their export trade was impeded by financial and exchange complications in many countries. These conditions affected all the companies in the group. No ordinary dividend was being paid by two of their principal subsidiaries, and this meant a net loss to the A.E.I. of £70,959. Regarding the activities of their companies, the work of the B.T.-H. Co. had been dealt with at the meeting of that company held the previous day (see our last issue). Referring to the Metropolitan-Vickers Electrical Co., Ltd., he said that a noteworthy contract secured during the year was for a 105,000-kW turbo-alternator for installation in the Battersea power station of the London Power Co. Important switchgear contracts were received from the same company, one for the extension of the Battersea main switchgear and the other for sub-station equipment, which embodied a novel type of single-break circuit-breaker developed by Met.-Vickers. Following an order for two 60,000-kW turbo-alternators for the Fulham power station, they had secured the order for the switchgear for the same undertaking, this being the largest switchgear order placed in this country during the year. From Messrs. Stewarts & Lloyds an order was received for a complete rolling mill equipped for a strip mill comprising d.c. motors varying in size from 100 to 2,000 h.p., together with the necessary Ward Leonard motor-generator sets. They had also received an order for a five-ton induction furnace equipment, which was the largest of its kind in this country. Considerable progress was made during the year in the development of industrial motors and control gear to meet the special requirements of the coal, iron and steel industries. The South African market had been particularly active, and amongst other items Metropolitan-Vickers had shipped to the New Consolidated Goldfields a winding equipment capable of a maximum peak load of 5,000 h.p., and a similar equipment for the Rand Mines with a maximum output of 4,700 h.p. An order had also been received from the Victoria Falls Power Co. for a 20,000-kVA synchronous condenser, a duplicate of three already in operation. A contract was secured jointly by the Metropolitan-Vickers Co. and the English Electric Co. for the electrification of the Central Junction station at Warsaw, and for a distance of about 50 km. on each of the three lines proceeding therefrom. This order comprised electrical equipment for rolling stock, electric locomotives, sub-station equipment and overhead gear. These orders were outstanding achievements, but the bulk of the Metropolitan-Vickers business was in the small types of apparatus, such as small motors, transformers, meters, instruments and small switch and control gear. In the Research Department much useful work was done during the year. Considerable progress was made in the investigation of the properties of steel for high temperatures and pressures, and the results had greatly influenced the design of high-temperature turbines now under construction. Further progress had been made in the investigation of noise with a view to producing machines which were as free from noise as possible, and noise-measuring apparatus had been added to the company's selling activities. An item of special interest was the installation of a 250,000-V continuous evacuated X-ray tube in the Sheffield Royal Infirmary. Two similar installations would very shortly be in operation in other hospitals. The B.T.-H. Co., Ferguson, Pailin, and the Metropolitan-Vickers Co. were jointly erecting a modern high-power testing plant which would be capable of dealing with rupturing tests on the largest types of switches required in this market or abroad. This plant would be ready for service at an early date. Last year they had practically no orders from Russia, but there appeared to be every probability of the U.S.S.R. placing orders with them this year, and in that connection the completion of the trade agreement between this country and Russia was welcome. They were still suffering from a reduced demand for electrical products and a consequent excess of productive capacity in the electrical industry. So far as the industry as a whole was concerned the problem of dealing with excess manufacturing facilities was still engaging their attention in association with their principal competitors. Personally, he was attracted by "planned control" of industry, believing that a complete solution of the problem was not to be found by large-scale amalgamations. Much could be done by co-operation between members of the industry. With regard to amalgamations, in which their company's name was not infrequently coupled with that of the General Electric Co., Ltd., those who had been much longer associated with the electrical industry than he had held strongly the view that such an amalgamation would not be in the best interests of the industry or of the shareholders. But

[*Lafayette*

Sir Felix Pole

they were co-operating closely with some of their competitors in a number of directions; they were working together in certain research problems and pooling the results, and they were jointly interested financially with some of them in the production of certain articles and semi-finished parts. In this way they could make sure that the electrical industry was self-contained and that national efficiency could best be served. The scramble for the reduced volume of work available had led to excessive price-cutting and reduced profits. So far as the prospect for orders in the immediate future was concerned, their order book to-day was very much greater than it was this time last year; and in their works they were already employing many more men than at this time last year. The report and accounts were adopted and a resolution for the conversion of the shares into stock was carried.

The Marconi International Marine Communication Co., Ltd.—Presiding at the annual meeting held on April 12th, Mr. J. C. Denison-Pender (chairman) said that, in general, 1933 was little better than the two preceding years from the normal business aspect. They were mainly interested in ships of 1,600 tons and over. In 1933, up to the end of June, only two vessels coming within this category were launched; in July, however, a barely appreciable improvement began. The Marconi Sounding Device Co. had booked nearly 900 orders to date and was gradually achieving a satisfactory financial position. The electrical service department was also showing considerable progress. Last year it had under its care the installations of nearly 130 ships, and, since then, it had carried out the complete outfit of two new ships and looked after the electrical equipments of 320 ships. Another branch which was forging ahead was the provision of wireless telephone equipment for ships. At the moment there were 321 ships of all kinds carrying their wireless-telephony installations. They continued to co-operate with the General Post Office to gather experience and aid in the development of a wireless telephone communications network. For some time past it had been possible with small-powered wireless telephone installations on craft at sea to communicate direct with telephone subscribers on shore, while from the larger ocean-going vessels perfect conversations took place between distances of thousands of miles. The administrative offices of the company had been transferred to Electra House, Victoria Embankment, which also housed the offices of Cables & Wireless, Ltd., Imperial and International Communications, Ltd., and Marconi's Wireless Telegraph Co., Ltd. Steps were now being taken to bring about closer co-operation in other ways in the mutual interests of these concerns. Lord Inverforth, chairman of Marconi's Wireless Telegraph Co., had been requested by the board to become joint president with the Marchese Marconi, and, in addition, Lord Inverforth, Mr. E. Wilshaw, a director of Marconi's Wireless Telegraph Co., and a director and chief general manager of Cables & Wireless, Ltd., and Mr. H. A. White, managing director of Marconi's Wireless Telegraph Co., had been asked to join the board. This action in no wise interfered with the independence or individuality of their company, which, as its shareholding was at present constituted, must remain a separate entity from other companies in the group.

The Notting Hill Electric Lighting Co., Ltd., held its annual general meeting last Friday. Mr. Arthur Ellis Franklin, J.P. (chairman), who presided, referring to the report (see April 6th issue, page 507), said that sales of electricity had increased by 885,000 kWh, and there were 982 new consumers. The cost of the 16,333,738 kWh purchased from the London Power Co. was £45,196, as against £50,044 for 15,057,244 kWh in the preceding year. The most important event of the year was the settlement of the new standard prices. The standard price in 1933 was 3.085d. per kWh, and the average charged was 2.555d. Each £8,118 saved by concessions to consumers enabled the company to distribute an extra 1 per cent. as dividend, providing profits were available. During the past year earnings showed an excess of over £7,000, which was disposed of by returning 5 per cent. as a special rebate to consumers; in the preceding year the company gave a rebate of 8 per cent. or £11,000. The consumer received, collectively, a rebate of 12 per cent. for 1932 and 15 per cent. for 1933, the co-partner employé received 13 per cent. and 15 per cent., and the ordinary shareholder had his dividends raised from 8 per cent. to 10 per cent. and 11 per cent. respectively. Output continued to expand, and to encourage consumption a two-part tariff was introduced and many consumers were now taking advantage of it. The chairman announced the resignation of Mr. R. G. Rawkins from the position of secretary and manager to the company, but said that he would still retain his seat on the board; his son, Mr. E. G. Rawkins, has been appointed secretary.

The English Electric Co., Ltd., report a trading loss for 1933 of £175,680, as compared with a profit of £106,196 in the preceding year, and after providing for debenture interest, &c., a loss for the year of £267,837, which with a debit balance of £9,433 brought in, leaves a debit of £277,270 to be carried forward. The report states that the two main reasons for the loss on the year's trading are reduced turnover and exceptionally low prices. The turnover in 1933 was 69 per cent. of that in 1930, and during these three years prices of the products manufactured by the company have fallen on the average by 25 per cent. and in some cases the fall has even approached 50 per cent. The lower volume of business obtained is due to the shrinkage of business placed in the home and export markets combined. In their endeavour to counteract as far as possible the trading conditions, the directors have effected economies, including a voluntary reduction of 10 per cent. in all fees and salaries paid to the directors and staff, developed the manufacture of lighter and ancillary types of electrical apparatus on which the margin of profit has not yet been eliminated, and have exerted their powers to further rational co-operation amongst the leading firms in the industry. The value of unexecuted orders at March 31st last was approximately 80 per cent. greater than at the same time last year. This increase was due principally to important contracts received in the later months of 1933 and the early part of this year. The prices at which recent orders had been taken were rather better than those obtained in the first half of 1933. Meeting: April 24th.

The Ever Ready Trust Co., Ltd.—Presiding at the annual meeting on April 16th, Mr. M. Goodfellow (chairman and managing director) said that the Lissen accounts, already published, showed that, while an increase in sales over the previous year was achieved, the various rises in the cost of obtaining business against increased competition caused the profit for the year to fall from £174,000 in 1932 to £130,000 in 1933. The Ever Ready Co. (Great Britain), Ltd., was acquiring 170,000 ordinary shares in Lissen, Ltd., and would then practically own the whole of the ordinary share capital of Lissen, Ltd. Work was actively proceeding for the purpose of bringing about a closer co-operation between the two businesses. Regarding the Trust Co., it was their present intention to pay an interim dividend at the end of October next.

Babcock & Wilcox, Ltd., in their report for 1933, show a balance available of £242,180, less £16,916 contributed to the staff pension fund. To this is added £21,056 brought in and £50,000 transferred from dividend equalisation fund, making £159,854. It is proposed to pay a final ordinary dividend of 3 per cent., making 6 per cent. for the year, and to carry forward £23,388. The report states that the difficult conditions of 1932 continued during practically the whole of the year under review, and under these conditions the results shown are considered to be satisfactory.

The General Electric Co. of New York reports net sales for 1933 of $136,637,268, as against $147,162,291 for 1932, and a net income of $13,429,739 (against $14,404,110). Quarterly dividends of 15 cents per share have been paid on the special stock and 10 cents per share on the common stock.

Ericsson Telephones, Ltd., reports that after providing for depreciation, income-tax, &c., there was a net profit for 1933 of £68,496, as against £47,525 in 1932, to which is added £31,000 brought in, making £99,596. Reserve receives £15,000, it is proposed to pay a final ordinary dividend of 7½ per cent., making 13½ per cent. for the year (against 12 per cent.), and to carry forward £34,594.

The Telegraph Condenser Co., Ltd., in its first accounts for the period June 15th to December 31st last, shows a net profit of £16,336. This represents seven-twelfths of the net profits for the whole year in accordance with the agreement under which the business was taken over. An ordinary dividend of 5 per cent. is proposed, and £3,061 is carried forward. Meeting: April 23rd.

The British Engine Boiler & Electrical Insurance Co., Ltd., in its report for 1933 states that an interim dividend of 15s. per share, less tax (same) was paid in June last, and that after transferring £25,000 to the pension fund and £11,000 to reserve, there is a balance of profit of £24,182. It is proposed to pay a final dividend of 15s. per share, less tax (unchanged), which will absorb £11,475.

G. D. Peters & Co. report a net loss of £53,272 for 1933. A sum of £50,000 is transferred from reserve (against £40,000 last year), while credits arise of £2,987 for income-tax reserve not required. After deducting the loss for the year, a balance of £3,667 is carried forward against £1,452 brought in.

Telephone Properties, Ltd., reports a net profit for 1933 of £39,270, as compared with £33,244 for the preceding year. The preference dividend absorbs a larger amount at £17,312, and it is proposed to pay a final ordinary dividend of 4 per cent., making 6 per cent. for the year (against 8 per cent.). The carry-forward is increased from £5,696 to £9,162. Meeting: April 20th.

The Calcutta Electric Supply Corporation, Ltd., proposes to pay a final ordinary dividend of 7 per cent. (actual), making 12 per cent. for 1933, and a bonus in cash of 2d. per share (unchanged).

The Adelaide Electric Supply Co., has announced an interim ordinary dividend of 5 per cent., tax free, against 4½ per cent.

Stocks and Shares

Tuesday Evening.

THE Budget is the main topic of interest this week. Its provisions were anticipated with pleasurable feelings, which found reflection in strength through all the purely investment markets of the Stock Exchange. It is axiomatic that a decrease in the income tax is a bull point for gilt-edged stocks, the converse being equally true: that is, a rise in taxation spells, in theory, lower prices for the purely investment securities. Financial conditions throughout the world have conspired to give the stocks and shares connected with our own country a peculiarly high value that calls for genuine congratulations on the one hand, a reason for mild regret on the other for those people who wish to invest money at the present time, and who find the returns which they can obtain from good-class stocks and shares is abnormally low. There is renewed talk in the air of a forthcoming issue of stock from the Central Electricity Board. It may be recalled that a similar report was current some six weeks ago, to be, however, contradicted at that time. The reduction of sixpence in the income tax will make money conditions even easier than they have been hitherto.

Gilt-edged Securities

Central Electricity stocks are nearly all a point higher on the week. No changes have occurred in London Passenger Transport issues. Small amounts of debenture stock can be obtained in a few of the Home electricity undertakings. The yields are mostly a trifle under 4 per cent. on the money. A new issue of County of London preference share capital is reported to be in course of preparation.

Home Electricity Supply

The deduction of the dividends from the prices of most of the issues in the London electricity supply companies has now been recovered. The movement started a week ago, as our price-lists indicated. It has made further progress, without, however, causing any particular changes in the quoted prices. In the provincial group, Bournemouth and Poole are a trifle easier at 77s. 6d. West Gloucestershire ordinary is 2 points lower at 86, a little selling having been encouraged by the very substantial rise that had taken place in the previous fortnight. The company's 6½ per cent. participating preference stock remains at 120. The same people who have been buying West Gloucestershire stocks are now inquiring for Cornwall Power preference. The nominal price is 22s. 6d.; there is pronounced difficulty in obtaining any but a small amount of stock.

Manufacturing and Equipment

British Insulated ordinary have gone back to 68s. 9d., and Enfields to 82s. 6d., showing a loss of 1/8 and ½ respectively. On the other hand, Callender's are better at 58s. 3d. A demand sprung up for Electric Construction shares, raising the price by 2s. 6d. to 13s. 9d. Associated Electric Industries shares have advanced to 18s. 6d. Ever-Ready shares are 6d. lower at 29s. At the meeting of the Ever-Ready Trust held this week the chairman referred to the fact that the number of investments has been brought up to 66. New holdings have been acquired, largely of British Industrials. The investments show an appreciation of £79,000 over and above the book cost. It was stated at the meeting that the accounts of the Ever-Ready Company of Great Britain would be out shortly, and would prove to be satisfactory.

Johnson and Phillips at 20s. 9d. are 9d. to the good. Philips Incandescent Lamps keep steady at 46s. 9d. Chloride Electrical Storage "A" and "B" are quoted at the common price of 29s. 6d., Enfield Rolling Mills are 34s., and Ericsson Telephone ordinary 73s.

English Electric Results

The English Electric Company has published a report this week showing a trading loss of £175,681, which goes against a profit in the preceding twelvemonth of £106,000. The net loss for the year is £267,837, and a deficiency is carried forward of £277,270, the difference being accounted for by the debit-balance brought in. According to the report, the value of unexecuted orders on the books at the end of last month was approximately 80 per cent. greater than at the same date last year. The loss appears to be due to excessive competition at home, and the difficulty experienced in markets abroad. Acceptance of orders at unprofitable prices served to keep the machinery running, and the directors deplore cut-throat competition which has resulted, in the case of the English Electric Company, so disappointingly in respect of the year just ended. The prices of the ordinary and the preference shares were standing, before the report appeared, at 7s. 6d. each. On announcement of the figures, the ordinary fell back to 6s. 6d., but the preference hardened to 8s. 6d., the nominal quotations remaining unchanged.

Cables and Wireless

Higher prices are quoted for Cables and Wireless issues. Support was stimulated by the better showing made by the Board of Trade returns relating to exports. The Combine has not yet started business in Shorter's Court, where the Stock Exchange arbitrageurs deal with their "opposite numbers" in New York. It is said in the House, however, that Cables and Wireless succeeded, a few days ago, in getting a message from the London Stock Exchange to a New York firm, and an answer back again, in 18 seconds, all the conditions being favourable to what, even so, is a remarkable feat.

Globe Telegraph and Trust ordinary have reflected, with a rise to £10, the advance in Cables and Wireless. Marconi Marines are 1s. 9d. better at 32s. 6d., following upon a speech by the chairman at the annual meeting which demonstrated the energy exhibited by the Board in developing new sources of revenue.

Miscellaneous Matters

The dividend of Babcock & Wilcox for the final half-year, awaited with a measure of apprehension, is now declared at 3 per cent. actual. This makes 6 per cent. for the year. The price of the shares fell 3s. to 42s. 9d., to rally to 43s. 3d., leaving a decline of half a crown on the week. Iron and steel shares, speaking generally, are better. The effect of the Budget can hardly fail to direct renewed interest to this department, in view of the cheerful outlook for national trade that the Chancellor of the Exchequer inferred in his speech and subsequent broadcast talk. The rubber share market is also better. Industrial issues are mostly up in price, a considerable volume of business being noticeable in many markets round the Stock Exchange. Members are more fully occupied with orders than they have been for five years. Many South African mining shares are standing at the highest prices in their history. Victoria Falls ordinary at 6 1/16 have participated in the strength. Anglo-Americans have fallen somewhat out of favour. Investment and speculation are intent upon other areas. A gamble in West Africans had no effect outside its own particular field of interest.

Share List of Electrical Companie

Home Electricity Companies

	Nom.	Dividend. 1932.	Dividend. 1933.	Price. Apl. 17.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	77/6	−⅛	3 17
Brompton Ordinary	1	7	7	34/6	—	4 1
Charing Cross Ordinary	1	7	7	35/6	—	3 19
Chelsea	1	7	7	34/6	—	4 1
City of London	1	7½	7½	37/–	—	4 1
Clyde Valley	1	7	7	42/6	—	3 5
County of London	1	10½	10½	59/6	—	3 11
Edmundson's 7% Pref.	1	7	7	34/–	—	4 2
Elec. Dis. Yorkshire	1	9	9	48/9	—	3 13
Elec. Supply Corporation	1	11	11	76/3	—	2 17
Kensington Ordinary	1	7	7	35/–	—	4 0
Lancs Light and Power	1	7	7½	38/9	—	3 17
London Electric	1	7	7	35/6	—	3 19
Metropolitan	1	10	10	53/–	—	3 15
Midland Counties	1	7	7	38/9	—	3 12
Mid. Elec. Power	1	8	8	42/6	—	3 15
North Eastern Electric Ordinary	1	6	6	35/–	—	3 8
Do. 7% Pref.	1	7	7	35/–	—	4 0
Northampton	1	10	10	56/3	—	3 11
Notting Hill 6% Pref.	10	6	6	13⅜	—	4 8
North Met. Elec. Ordinary	1	10	10	63/9	—	3 2
Do. do. 6% Pref.	1	6	6	31/6	—	3 16
St. James' and Pall Mall	1	7	7½	36/6	—	4 3
Scottish Power	1	8	8	2⅛	—	3 17
South London	1	7	7	36/6	+1/–	3 16
Westminster Ordinary	1	7	7	35/–	—	4 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/–	—	6 16
Yorkshire Elec.	1	8	8	49/6	—	3 4

Public Boards.

		1931.	1932.			
Central Electricity, 1950–70	Stock	5	5	115	+1	4 7 0
Do. 1955–75	,,	5	5	116	+1	4 6 2
Do. 1951–73	,,	4½	4½	111	+1	4 1 1
Do. 1963–93	,,	—	3½	98	+1	3 11 5
London & Home Counties, 1955–75	,,	4½	4½	110	—	4 1 10
London Passenger Transport, A	,,	—	4½	118½	—	3 16 0
Do. do. B	,,	—	5	120½	—	4 3 0
Do. do. C	,,	—	—	78½	—	—
West Midlands Joint Elec. 1948–68	,,	—	5	113	—	4 8 6

Telegraph and Telephones.

American Tel. & Tel.	$100	9	9	116	+½	7 1
Anglo-Am. Tel. Pref.	Stock	6	6	113½	—	5 5
Do. Def.	,,	1½	1½	28	—	5 7 2
Cables & Wireless 5½% Pref.	,,	2¾	2¾	73	+½	3 15 4
Do. A. 7½% Ord.	,,	Nil	Nil	23½	+½	—
Do. B. Ord.	,,	Nil	Nil	10¼	+¼	—
Globe Tel. and T. Ord.	10	Nil	2½	10	+¼	2 11 3
Do. do. Pref.	10	6	6	12⅞	—	4 13 4
Great Northern Tel.	10	20	20	38	+½	5 5 3
Marconi-Marine	1	10	7½	32/6	+1/9	4 12 4
Oriental Telephone Ord.	1	12	12	3½	—	*3 16 10

Home and Foreign Trams, Etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	2/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	6	—	—
British Electric Traction Df. Ord.	,,	5	5	630	+10	—
Do. do. Pref. Ord.	,,	8	8	157½	—	5 1 7
Brazil Traction	100	—	—	11	−¼	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	102½	—	4 17 6
Mexico Trams, 5% Bonds	—	5	5	19½	—	25 12 8
Mexican Light Common	100	Nil	Nil	8	—	—
Do. 7% Pref.	100	7	7	11	—	—
Do. 1st Bonds	—	5	5	49½	−1	10 10 6
Victoria Falls Ord.	1	15	20	6 1/16	+¼	3 7 4
Yorkshire (West Riding)	1	2½	5	1	+1/16	5 6 8

Manufacturing Companies.

Assoc. Elec. Ord.	1	4	3	18/6	+9d.	3 7 7
Do. Pref.	1	8	8	31/3	—	5 2 5
Babcock & Wilcox	1	14	9	43/3	−½	2 15 6
British Aluminium Ord.	1	5	5	29/–	—	3 9 0
British Insulated Ord.	1	15	15	68/9	−1/16	4 7 3
Brush Ord.	Stock	Nil	Nil	35	−3	—
Callender's	1	15	15	58/3	+9d.	5 3 4
Do. 6½% Pref.	1	6½	6½	30/9	—	4 4 6
Crompton Parkinson Ord.	5/–	22½	12½	23/6	−1/6	—
Do. 8% Pref.	1	8	8	31/3	—	5 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	6 2 5
Do. 5% Deb.	Stock	5	5	102½	—	4 17 7
Electric Construction	1	Nil	Nil	13/9	+¼	—
Enfield Cable Ord.	1	25	25	82/6	−½	4 12 7
English Electric	1	Nil	Nil	7/6	—	—
Do. do. Pref.	1	Nil	Nil	7/6	—	—
Ever Ready	5/–	35	35	29/0	−6d.	6 0 8
Ferranti Pref.	1	7	7	26/–	—	5 7 9
G.E.C. Pref.	1	6½	6½	30/9	—	4 4 5
Do. Ord.	1	8	8	42/6	+6d.	3 15 1
Henley's	1	30	30	6	—	4 17 10
Do. 4½% Pref.	5	4½	4½	5½	—	4 5 9
India-Rubber Preferred	1	—	—	15/–	—	—
Johnson & Phillips	1	5	5	20/9	+9d.	4 16 5
Siemens Ord.	1	7½	6½	18/9	—	—
Telegraph Construction	£1	Nil	Nil	23/9	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1932

4229. "Electric cables." H. Rost. September 16th, 1932. (407718.)

18147. "Overhead conductor systems for electrically driven vehicles of the railless type, also applicable to street lighting." K. E. North and Estler Bros., Ltd. June 21st, 1933. (407732.)

20621. "Impulse transmitters for automatic telephone systems." Hall Telephone Accessories (1928), Ltd., and F. W. Hall. July 21st, 1932. (407692.)

23492. "Control systems for the field windings of dynamo-electric machines." British Thomson-Houston Co., Ltd. August 21st, 1931. (407711.)

24052. "Apparatus for measuring the electrical conductivity of liquids." Thermal Syndicate, Ltd., and B. Moore. August 29th, 1932. (407734.)

24217. "Sparking plugs." J. E. Jowitt. September 29th, 1932. (407735.)

25781. "Appliances or apparatus employing high frequency electric current for medical or curative purposes." W. E. Holder. September 16th, 1932. (407679.)

25934. "Auxiliary excitation circuit for grid-controlled metal-vapour rectifiers." Siemens-Schuckertwerke Akt.-Ges. September 19th, 1931. (407724.)

26028. "Electric converting apparatus." British Thomson-Houston Co., Ltd. September 19th, 1931. (407714.)

26051. "Luminous indicators for supervising technical plants." Akt.-Ges. Brown Boveri et Cie. September 17th, 1931. (407715.)

26121. "Indicating systems particularly adapted for railway indicating systems." Standard Telephones & Cables, Ltd., and J. B. Griffiths. September 20th, 1932. (407682.)

26210. "Combined switches and coupling sockets." J. A. Crabtree. September 21st, 1932. (407697.)

26249. "Electrolytic apparatus." D. J. Evans. September 21st, 1932. (407700.)

26263. "Combination switch for the ignition of other electric circuits of motor vehicles or other purposes." W. Martell. September 21st, 1932. (407703.)

26280. "Devices for converting or translating acoustic energy into electrical energy, and vice versa." E. L. Francis (R. L. Steinberger). September 21st, 1932. (407704.)

27037. "Systems for the reception and transmission of intelligence by wireless." C. Lorenz Akt.-Ges. October 22nd, 1931. (407739.)

27462. "Electro-responsive systems for use particularly for protective purposes." A. S. Fitzgerald. October 3rd, 1931. (407745.)

[illegible]25. "Insulator devices." A. V. Pettman and W. Reed-[illegible] bridge. December 19th, 1931. (407750.)

28687. "Photo-electric cells." C. Zeiss. October 20th, 1931. (407755.)

29062. "Electrical conductors and methods or processes of producing the same." J. P. Jackson. October 18th, 1932. (407757.)

29346. "Electrically operated cranes, windlasses, and the like." G. R. Adamson and J. Adamson (trading as J. Adamson & Co.). October 20th, 1932. (407760.)

30680. "Electric safety lamps." C. Rave. August 11th, 1932. (407766.)

30951. "Telephone instruments employing key or like switches." Ericsson Telephones, Ltd., G. R. Newell, and F. Hollis. November 3, 1932. (407771.)

31035. "Electric welding devices." C. G. Colver. November 3rd, 1932. (Cognate application 10215/33.) (407772.)

31450. "Adjustable arms or brackets for carrying electric lamps." Electric Depot, Ltd., and W. H. Bill. November 8th, 1932. (407775.)

32186. "Reduction of sparking at contacts in making and breaking electric circuits." Siemens Bros. & Co., Ltd., and H. J. Edwards. November 14th, 1932. (407780.)

35615. "Electric switches or circuit interrupters of the explosion-pot type." D. R. Davies and Associated Electrical Industries, Ltd. December 15th, 1932. (407793.)

1933

51. "Clamping means or the like for electric wires." E. B. Andreae. January 2nd, 1933. (407798.)

164. "Synchronous motors, particularly adapted for use in electric clocks or the like." Eltime Clock Co. January 14th, 1932. (407800.)

196. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and A. H. Maggs. September 20th, 1932. (Addition to 385986.) (Divided application on 385986.) (407687.)

2127. "Electrically operated positioning apparatus." Bailey Meter Co. January 26th, 1932. (407806.)

2661. "Telephone instrument circuits." Siemens Bros. & Co., Ltd., and E. R. Wigan. January 27th, 1933. (Addition to 372,400.) (407808.)

2824. "Electric imitation fires." J. Jardine and British National Electrics, Ltd. January 30th, 1933. (407810.)

6314. "Arrangement for producing rectangular picture in television receivers employing a cathode-ray tube." M. Von Ardenne. March 7th, 1932. (407823.)

7988. "Sound wave systems." British Thomson-Houston Co., Ltd. March 16th, 1932. (407826.)

8853. "Electric starters for internal combustion engines." Etablissements Labinal. December 12th, 1932. (407828.)

10180. "Terminal fitting or connector for sparking plugs or the like." L. B. Dawson. April 15th, 1933. (407831.)

13642. "Electrical apparatus for generating voltage impulses." International General Electric Co., Inc. May 10th, 1932. (407837.)

16751. "Electrical transmission systems." Massachusetts Institute of Technology. July 5th, 1932. (407847.)

17927. "Electromagnetic burglar and like alarm devices." G. Morel. June 23rd, 1933. (407849.)

18517. "Quick-action automatic electric circuit-breaker." Maschinenfabrik Oerlikon. July 5th, 1932. (407853.)

19068. "Dynamo-electric machines." English Electric Co., Ltd., and C. S. Donaldson. July 5th, 1933. (407855.)

19454. "Device for the mains-supply operation of cathode-ray tubes." Radioakt-Ges., D. S. Loewe and K. Schlesinger. July 11th, 1932. (407857.)

20179. "Mercury or like electric switches or relays." H. Terrell and R. R. Poole. July 17th, 1933. (407861.)

20192. "Circuits for mercury-vapour rectifiers." Siemens-Schuckertwerke Akt.-Ges. July 18th, 1932. (407862.)

20273. "Devices for exactly measuring or comparing impedances." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 19th, 1932. (407863.)

22391. "Radio aerial attachments." Amy, Aceves & King, Inc. August 10th, 1932. (407872.)

22742. "Electric elevator systems." Westinghouse Electric Manufacturing Co. August 25th, 1932. (407875.)

24308. "Directional radio antenna systems." Marconi's Wireless Telegraph Co., Ltd. September 1st, 1932. (407881.)

25171. "Four-wire telephone systems." Siemens & Halske Akt.-Ges. September 10th, 1932. (Cognate application 25172/33.) (407884.)

26079. "Control or regulation of electricity generating apparatus." Chance Bros. & Co., Ltd., and J. H. Abbink-Spaink. September 21st, 1933. (407885.)

29316. "Differential electric condensers." Cromwell (Southampton), Ltd., and H. A. Brooke. October 23rd, 1933. (407894.)

33648. "Shock-proof hoods or sleeves for X-ray tubes." C. H. F. Muller Akt.-Ges. December 1st, 1932. (407902.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 11th:—

Sunbeam (lettering and design). No. 547835. Class 8. Secondary batteries for radio purposes.—Fuller Accumulator Co. (1926), Ltd., Woodland Works, Chadwell Heath, Essex.

Aladdin. No. 543764. Class 25. Lamp shades.—Aladdin Industries, Ltd., Long Drive, Greenford, Middlesex.

The Finnish Electrical Market

THE prospects of increased imports of electrical machinery and apparatus from the United Kingdom to Finland are dealt with in a report on the "Economic Conditions in Finland, 1933," prepared by Mr. R. K. Jopson, Commercial Secretary to H.M. Legation at Helsingfors, for the Department of Overseas Trade (Stationery Office, 2s. 6d. net).

Mr. Jopson states that while Finland does not present a very valuable market for electrical equipment it would seem that British manufacturers in the past have taken little interest in the country, the field having been left almost entirely to German and Swiss competitors, with the consequence that Continental practice has been adopted throughout the country, metric measures and standards are in vogue, the I.F.K. standards and tests being applied to installation material, and German standards to other electrical apparatus.

Where electrical apparatus is made in the country, substantial preference is given to the local manufacturers, and this applies to such products as lamps (domestic output 1,200,000 per annum or about one-half of the demand), transformers up to 10,000 kVA, electric motors, rubber-covered cables and some telephone cable, outdoor pin-type porcelain insulators for up to 35 kV and certain classes of switch and control gear. The chief imports are switchgear, transformers, meters, instruments, storage batteries, domestic apparatus, radio, telephone and telegraph apparatus and electro-medical equipment.

In recent years the import of electrical material has progressively declined, but if conditions continue to improve a marked development may be anticipated within the next decade. Domestic and agricultural electrical development is still backward, though efforts are being made to induce the Finnish housewife to become more electrically minded. The report states that there is no reason why the United Kingdom electrical industry should not secure an increased share of the Finnish market, but in order that it may do so an overhaul of the existing marketing methods and the pursuit of a more intensive study of the special requirements of the market are essential.

The local supply authorities and important users of power all complain that representatives of British firms do not pay frequent enough visits to the country, that no advertising is conducted in the vernacular technical Press, and that no local organisation exists through which buyers may obtain information relating to the products of the British electrical industry. In 1932 the imports of electrical machinery totalled 837 metric tons, and of insulated electric cables 881 metric tons, while for the first nine months of 1933 the figures were 743 and 617 metric tons respectively.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Maternity hospital (£40,000); J. B. Nicol, architect, 367, Union Street.

Accrington.—Skating rink, Cannon Street; Wilson & Barlow.

Airdrie.—Public baths; burgh surveyor.

Ashby-de-la-Zouch.—Houses (28), Burton Road; U.D.C. surveyor.

Ashton-in-Makerfield.—Houses (30), Downall Green; U.D.C. surveyor.

Barkingside.—Houses (223), Parkside Estate, Longridge Road; Lord & Mellowdew, Ltd.

Barrachnie (Lanarkshire).—Houses (356), Garrowhill Estate; Henry Boot & Sons, Ltd., Moore Street, Sheffield.

Bedford.—School, London Road housing estate, for Borough E.C.; S. C. George, secretary, 32, Bromham Road.

Billingham-on-Tees.—Houses (150); Kitching & Co., U.D.C. architects, 21, Albert Road, Middlesbrough.

Birmingham.—Houses, Pipe Hayes; Reynolds & Co., 10, Newhall Street. Cinema, Kettlenouse Road; B. G. Vale, 143, Poplar Avenue, Edgbaston. Factory, for the English Seamless Tube Co.

Blackpool.—Houses, Highfield Road; Beardshaw & Boardman.

Bournemouth.—Café, East Beach (£15,000); borough engineer.

Bradford.—Houses (50), Haworth Road; A. E. Hardy, 4, Ashwell Road, Heaton, and W. B. and F. H. Taylor, Albion Chambers, Hustergate. Houses (300), near the junction of Huddersfield Road and Netherlands Avenue; Spencer and Sharp, 654, Great Horton Road. Schools, Cooper Lane, Haworth Road housing estate and Eccleshill housing estate for E.C.; Mr. Fletcher, city architect, Town Hall.

Caithness.—Three schools, Lybster, Thurso and Wick (£70,000), for E.C.

Canterbury.—Houses (130); city surveyor.

Carlisle.—Houses (160), Knowfield, Stanwix; J. Laing & Sons, builders, Dalston Road. Bus station, Drovers Lane; Blair & Palmer.

Chadwell Heath.—Embassy cinema, High Road; H. Weston.

Cheshire.—School, Pensby, for County E.C.; county architect, Chester.

Chesterfield.—Central offices and workshops (£17,525), for the Chesterfield and Bolsover Water Board; clerk. Church, Newbold Road, for the Presbyterian trustees; Rev. G. M. Nicol, St. Andrew's Church, Sheffield.

Coulsdon.—Houses (1,560), Fairdean Heights Estate; Gunton & Gunton.

Derby.—Houses (100), Cowsley Estate; Harris Bros., builders, Marehay.

Dewsbury.—Houses (30), Scopsley Lane, and (64) Dawgreen; borough surveyor.

Doncaster.—Schools, Wheatley (500 places), for Borough E.C.; H. A. Hickson, architect.

Douglas (I.O.M.).—Church, Pulrose; Kelly Trust.

Driffield.—Houses (24); U.D.C. surveyor.

Duns.—Cinema, Easter Street; W. Barnett Wylie, architect.

Dunstable.—Houses (135), North Field Estate; T. Alwyn Lloyd, architect.

East Sussex.—School, Arundel Road, Seaford, for County E.C.; director of education, Lewes.

Eccles.—Labour exchange, Corporation Road, for H.M. Office of Works.

Gillingham (Kent).—Houses (26), Zetland Avenue, for A. Clifford & Co., and 24, St. Mary's Road, for C. J. Howard.

Glasgow.—Washhouses, Kelvin and Govan (£57,000); city engineer. School (800 places), Braehead Street; education director.

Golcar.—Business stores, electrical and heating work, for the Co-operative Society; C. F. Mallinson & Son, architects, Market Place, Huddersfield.

Gorleston.—Extensions, East Anglian Schools, Church Road; Governors.

Hampton.—Houses (26), Park Road; R. B. Powell. Indoor bowling green and club, Queen's Road; W. H. Peckover.

Hastings.—Houses (32), Clifton Road; B. F. Pennells, architect.

Hemel Hempstead.—Houses (50), Wood Lane; A. E. Brown, builder, the Broadway, West Ealing.

Hertford.—Bus garage and offices, Tamworth Road, for the London Transport Board; clerk.

Hoddesdon.—Houses (38);; Universal Housing Co., Ltd., builders.

Hyde.—Works extensions, Dowson Road; C. A. Harnden, Ltd.

Ilford.—Houses (406), Mossford Park Estate; New Ideal Homesteads, Ltd. Cinema, Cranbrook Road; S. B. Pritlove.

Ilkeston.—Houses (66), Nottingham Road; borough engineer. Houses (52), Southern Building Estate; H. Middleton, Hockley Mills, Nottingham.

Irish Free State.—(Ballinasloe, Co. Galway). Buildings for Mental Hospital for the Committee of Management; J. R. Boyd Barrett, Chartered Architect, 61, South Mall, Cork. (Charleville, Co. Cork).—Cottage Hospital, for North Cork Board of Public Assistance; Board's architect, County Home, Mallow. (Drogheda, Co. Louth).—National school, for the Christian Brothers; L. Turley, architect, 17, Laurence Street. (Tipperary).—Technical school, for the County Vocational Education Committee of Clonmel; T. F. McNamara & Sons, architects, 5, Dawson Street, Dublin.

Keighley.—Maternity and child welfare centre; borough architect, Town Hall.

Kent.—School, Hayes, near Bromley, for County E.C.

Knottingley.—Houses (36), Morley House Estate; R. K. Poskitt, builder.

Lancashire.—Extensions Grammar School, Stretford, for County E.C.

Leeds.—Factory, Beeston; J. Hardwick, chartered architect, Belmont Grove, Rawdon, near Leeds.

Liverpool.—Printing works, East Lancashire Road; E. C. Hulme, architect, Dominion Buildings, Brunswick Street.

London.—(Acton).—Houses (86), Tudor Gardens; Arthur Watson, Ltd. Flats (68), shops and bathing pool, Gunnersbury Lane; J. Stanley Beard & Clare, architects. (Crouch End).—Town hall and assembly rooms, Broadway (£122,000) for Borough Council. (Deptford).—Central clinic and offices (£12,000); borough engineer. (Ealing).—Cinema and shops, Sudbury Heights Avenue, for North West London Estate Co., Ltd.; A. P. Starkey, architect. Station Road, Harrow. Factory for the Associated Agricultural Processes, Ltd., Coronation Road; Sir A. Gibb & Partners. School, Ravenor Estate (£11,947); Hidden & Co. (Hammersmith).—Elementary school (800 places), for L.C.C.

Margate.—Cafés, restaurants, cinemas (£300,000), and promenade and sea wall, Cliftonville (£19,730), for Corporation.

Marlow.—Houses (63); U.D.C. surveyor.

Middlesex.—Secondary schools, Hayes, Mill Hill, and Edgware, for County E.C.

Moffat.—Houses (30); burgh surveyor.

Newburn-on-Tyne.—Houses (90), Newcastle-Hexham Road; Longstaff & Bain, builders, Denton Road, Lemington.

Newcastle-on-Tyne.—Houses (793), (£315,000); R. G. Roberts, housing architect, 18, Cloth Market. Workshops for the blind, Benwell (£22,000); J. & W. Lowry, builders, 50, Corporation Street.

Northolt.—Houses (81), Park Estate; Swannell & Sly, architects. Houses (1,000); Hayes Bridge Estate, Ltd.

North Riding.—School, Whitby (£12,500); J. R. White, county architect, County Hall.

Norwich.—Houses, Starling Road; Norwich Housing Society, Ltd.

Paignton.—Houses (85), Ailescombe Road; Eastley & Co.

Portsmouth.—Houses (66), Chatsworth Avenue; G. & W. Mitchell. Guildhall extensions (£40,000); city engineer. Church, for the Trustees of Devonshire Avenue Baptist Church (£5,000); W. M. Fielder, secretary.

Purley.—Houses (37), Famet Lane; E. T. Brown & Son.

Richmond (Surrey).—Bank, for Barclays Bank, Ltd., 7 & 8, George Street; Couch & Coupland, architects, 5, Duke Street.

Roxburghshire.—School, Hawick, for C.C.; Reid & Forbes, architects, 17, Great Stuart Street, Edinburgh.

Rugby.—Houses (24), Bawnemore, for T. W. Crowther; Franklyn Newman & Press, architects, 22A, Regent Street. Houses (200), Bilton Rise Estate, Bilton Hill, for Benn Farm Estate Co.; Willard, Son & Ellingham, Boughton House, Market Place.

Ryton-on-Tyne.—Houses (50), for aged people; U.D.C. surveyor.

St. Albans.—Houses (200), Napsbury Park Estate, for E. Stevens. Houses (32), for Batehwood Estates, Ltd. Houses (37); city surveyor.

Sanderstead.—Houses (310), Westfield Estate; J. Gerrard & Sons, Ltd.

Scarborough.—Houses (180); A. Moore, builder, Rockville, Stepney Road. Hospital, Woodlands Estate, for Governors Scarborough Hospital; W. Marchment.

Sheffield.—Cinema, Sicey Avenue, Brushes Estate, for Paragon Picture House (Sheffield), Ltd., Kings Chambers, Angel Street; W. G. Robson, Ltd., builders, Bamforth Street.

Southend-on-Sea.—Bathing pool for the Corporation.

South Molton.—Cinema, New Road, for Fred F. J. Sanders.

South Shields.—Houses (76), Marsden Road; R. M. Chapman. Houses (28), Westoe Village; Milton Swales. Houses (45), Windsor Gardens; G. Thornton. High School for Boys, Harton; borough engineer.

Stockport.—Extensions to nurses' home, Stepping Hill Hospital (£10,620); Peter Pierce & Son, architects, 30, St. Peters gate.

Stretford.—Houses (40), Bradfield Road; Freeman, Evans & Co. Houses (67), Haig Road; McLellan & Abel. Houses (32), Lindum Avenue; Smith & Allcock, Ltd. Houses (38), Manor Road; E. Jackson & Sons, Ltd.

Sunderland.—Houses (156), Grangetown Estate; W. & T. R. Milburn, 17, Fawcett Street. Houses (80), Leechmore Road; W. D. Alison, builder, "Hawthorns" Whitburn, South Shields. Houses (42), Redby Estate; W. C. Leech, builder, Coutts Road, Newcastle-on-Tyne.

Sutton Coldfield.—Houses (171), Boldmere Road; T. P. Smith, Ltd. Houses (31), Highbridge Road; Morris & Jacombs.

Thingoe.—Houses (47): Hunt & Coats, R.D.C. architects, 51a, Abbeygate Street, Bury St. Edmunds.

Torquay.—Houses (30), Shenley Road; J. H. Nankivell. Clinic and welfare centre, Barton (£5,033); borough engineer. School (480 places), for E.C. Additions to Palm Court Hotel, Torbay Road; W. Purkis. Extensions, Brampton Court Hotel, St. Luke's Road; G. W. Hands.

Wakefield.—Houses (172), Flamshaw Road, for G. Crook & Sons, Ltd.; J. Percy Frith, architect.

Walsall.—Houses (49), Three Council Estates (£13,400); L. G. Peace.

West Riding.—Schools, Armthorpe (360 places), and Sprotborough (200 places), for the County E.C.; education architect, Wakefield.

West Wickham (Kent).—Church, Hawes Lane, for the Wesleyan trustees; secretary.

Wigan.—Houses (72), Worsley Hall site; borough engineer.

Wolverhampton.—Houses (60), New Penn Estate; A. M. Griffiths & Son, Ltd. Factory extension, Stewart Street; H. Marcus Brown. Newspaper offices, Queen Street, electrical work; Wilson Lovatt & Sons, Ltd., builders, Clarence Street.

Worcestershire.—Senior school, Stourport; Director of Education, Worcester.

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E.R.31.

COMPANY MEETING.

ASSOCIATED ELECTRICAL INDUSTRIES, LTD.
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PROBLEM OF EXCESS MANUFACTURING FACILITIES.

THE 34th annual general meeting of this company was held on April 12th at Bush House, London, W.C.

Sir Felix J. C. Pole (the Chairman) said that the profit for the year, including dividends from subsidiary companies (which dividends in the aggregate were slightly less than the profits earned), amounted to £397,169, against £474,359, a decrease of £77,190. The consolidated balance sheet showed that the group had available in Government securities and cash £1,939,885, compared with £1,704,544 at the end of 1932.

The report recorded that the trading results reflected the industrial depression which had been the outstanding feature of the past two years. Orders executed during the year were considerably below the average of the previous ten years. Last year was one of the most trying years that their companies had ever experienced. No ordinary dividend was being paid by two of their principal subsidiary companies, which meant a net loss of £70,959 to the parent company. Regarding this loss and answering a question in a financial paper, he had to say that their practice had been to include dividends paid by subsidiaries in their current accounts; in other words, the accounts now presented reflected the loss of dividends in respect of 1933.

TRADE WITH RUSSIA.

After referring to some of the important contracts secured by the companies in their group, the Chairman said that last year they met during a period of anxiety following on the arrests by the Russian Government of six of the company's engineers. He was glad to say that they were all well and were now usefully employed in the Metropolitan-Vickers organisation. The incident was closed, but he was sure shareholders would wish to record their appreciation of the kind and sympathetic messages received by the company from H.M. The King and H.R.H. The Prince of Wales, and grateful thanks are due to H.M. Government and Sir Esmond Ovey for their energetic and most helpful action in the matter. Last year the company had practically no orders from Russia, but there appeared to be every probability of the U.S.S.R. placing orders with them this year, and in that connection the completion of the trade agreement between this country and Russia was most welcome. They are extremely pleased that the Overseas Trade Department of the Board of Trade last year entered into agreements with the Argentine Republic, Denmark, Norway, Sweden and Belgium, and it was to be hoped that this policy would be actively and successfully pursued by the Government.

The company was still suffering from a reduced demand for electrical products and a consequent excess of productive capacity in the electrical industry. Their own policy was to co-ordinate the activities of the companies embraced in associated electrical industries, and much useful work had been done in that direction. So far as the industry as a whole was concerned, the problem of dealing with excess manufacturing facilities was still engaging their attention in association with their principal competitors. Personally he was attracted by what was termed "Planned control" of industry, believing that a complete solution of the problem was not to be found by large scale amalgamations.

Meanwhile, however, much could be done by co-operation between members of the industry. In regard to amalgamations, in which their company's name was not infrequently coupled with that of the General Electric Co., those who had been much longer associated with the electrical industry than he had held strongly the view that such an amalgamation would not be in the best interests of the industry or of the shareholders. They are, however, co-operating closely with some of their competitors in a number of directions; they were working together in certain research problems and pooling the results, and they were jointly interested financially with some of them in the production of certain articles and semi-finished parts. In this way they could make sure that the electrical industry was self-contained and that national efficiency could best be served.

THE FUTURE.

The scramble for the reduced volume of work available had led to excessive price cutting and reduced profits. So far as the prospect for orders in the immediate future was concerned, he could speak most hopefully, and he was strengthened in his optimism by a recent business tour in Ceylon and India. Everywhere there were distinct signs of improvement, and their order book to-day was very much greater than it was at this time last year; and in their works they already had many more men—as a matter of fact about 2,000—than at this time last year.

When, however, one tried to visualise trading conditions for a long period ahead, one had to recognise that the world was still suffering from three disturbing factors, namely, political unrest, trade restrictions, and an uncertain currency situation. So long as these factors had to be reckoned with, it was impossible to be very optimistic regarding world trade. For the immediate future, however, he was satisfied that protection of our home market, arrears of capital expenditure, reduction of taxation, and encouragement by the Government of capital development by public authorities would keep our own factories busy, and would substantially reduce unemployment in this country.

The report and accounts were unanimously adopted, and a resolution was passed authorising the conversion of the company's shares into stock. 141

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